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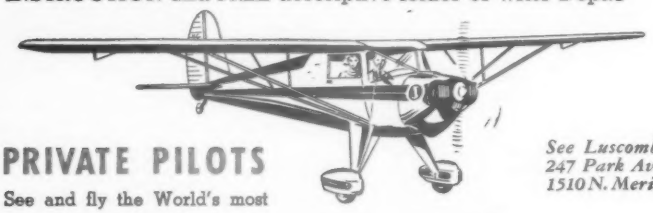

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The point to be borne in mind by you who are restless to get into aviation is that simply getting in is not enough. The young man referred to above is already in, but he wants to get ahead, and you will want to get ahead. You will want a better-than-even chance in competing for the available positions of trust and responsibility.

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WE will not be surprised if England, led by her Royal Air Force, wins the war in 1941. Few people seem to realize the scope of the offensive the British are almost sure to launch next spring or summer. The major portion of that offensive will be by air. Perhaps the size of the British Isles on a map of the world deceives most people. But only the aerial offensive itself will be launched from England proper; it is being prepared for in advance in practically every part of the world. Today British warplane production is tremendous, even from the standpoint of present American production. Canada already has trained tens of thousands of military flyers—and additional tens of thousands are to be trained. Several thousand flyers soon will come to the United States for initial training at many of those private flying schools throughout the country that have been training U. S. Army pilots. New Zealand, Australia, Africa as well as England are sending thousands of young men to Canada for training in flight, bombardment, gunnery and navigation.

By next summer the British will have thousands of first-line warplanes in reserve, including several thousand of the most modern American warplanes. The R.A.F. will have sufficient numbers of Bell *Airacobras*, Curtiss P-40's, Martin 167's, Douglas *Bostons*, as well as the veteran Lockheed *Hudsons*, on hand this spring—and production of these types is running *ahead* of schedule—to wipe the German air force out of the skies over England. Britain's long-range *Wellington* bombers will be augmented by numbers of Consolidated B-24's and Boeing *Flying Fortresses* (both brand new and U. S. cast-offs). They will carry the actual offensive over Germany. The B-17's will go over, accompanied by long-range, heavily-armed fighters, at altitudes up to 35,000 feet. German fighters will be almost helpless against them. Those bombers, using a gyroscopic bomb sight similar to, but *not*, ours, will go after German industry with no holds barred. At 35,000 feet British bombers will be well out of range of anti-aircraft; sound detectors are nearly useless at such range. German interceptors — even if they are warned of the bombers' approach—could not reach such high altitudes before the bombers' work was done and they were on their way home. So German—and Italian—industry will be subjected to devastating bombing raids in broad daylight as well as at night. The question will be, how long will Germany be able to stand "total war" more devastating than that to which London has been subjected.

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FLYING AND POPULAR AVIATION

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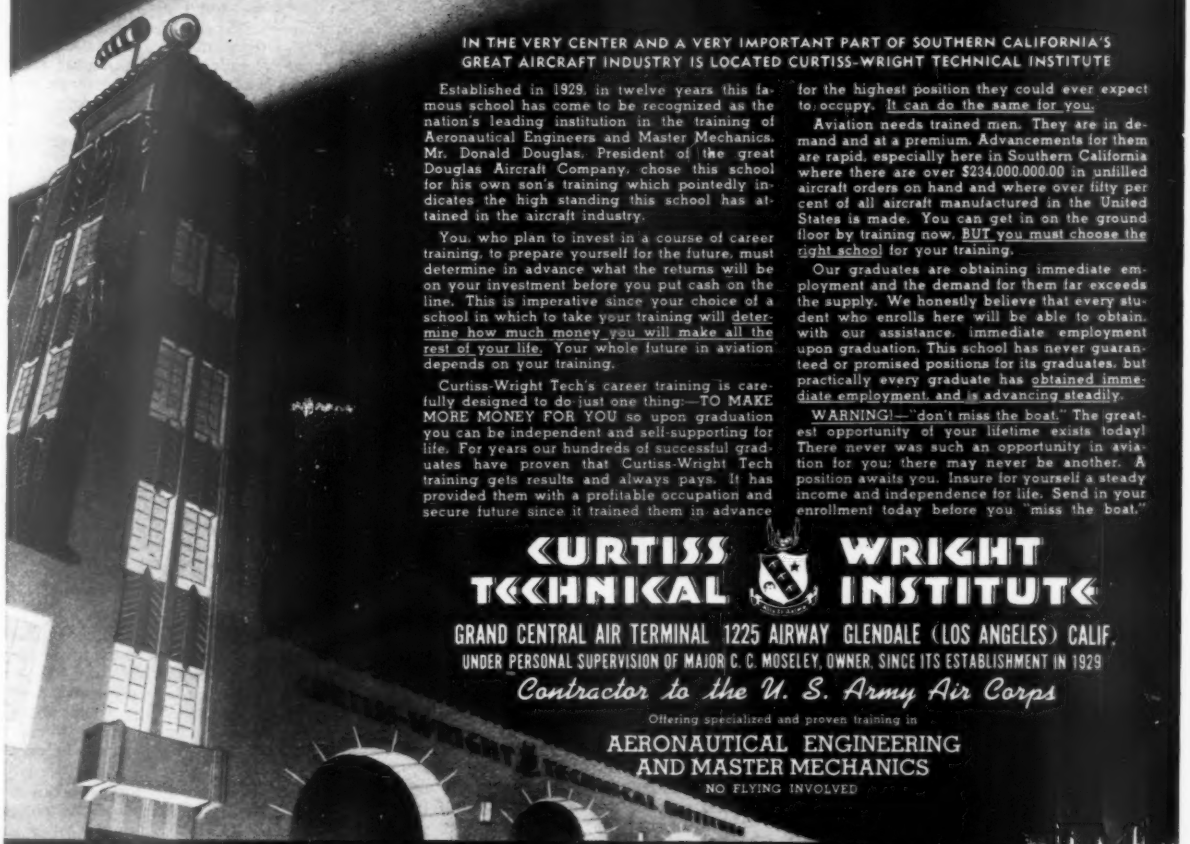

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Gentlemen, the world moves on. There used to be a time when solving puzzles was a sport for old ladies. But not any more—why, I've discovered you guys go after the answer to *Perch* puzzles with everything from a slide rule to an adding machine! To emphasize this trend further, this month's toughie was contributed by a Prof. from Virginia Poly! Hold your hats, boys—you're moving in fast company.

Major Al Williams, alias "Tattered Wing-Tips," Mgr., Gulf Aviation Products, Gulf Building, Pittsburgh, Pa.

MORE ABOUT INSIGNIA

Running this page certainly has its little problems. For instance, last month we promised that if you'd send in copies of private plane insignia, we'd print the best ones. You did and we got one that stood out above all the rest. It was a picture of that furious little fellow from the movie shorts who must remain nameless but whose initials are "D.D." Well, it seems "D.D." is so tied up by copyright, etc., etc., etc., that publishing his picture is a very risky business. So—the winning entry of Mr. G. V. Stedman of Wyoming, Pa., cannot grace our page. You'll just have to imagine how good it is!

OL' WASHBOARD GOT US!

When I was a little boy, we had a colored maid who was famous throughout the neighborhood for the excellence of her laundering. How she ever got sheets, pillowcases, and shirts so snowy white, was a secret she would share with no one.

However, I finally wormed it out of her one day. "Mistah Al," she told me, "here's how Ah does it. Ah washes them clo's till they's clean—an' then Ah *launders* them!"

We could apply a lot of technical names to it, but that's just about the same system we follow in refining Gulfpride Oil. We "wash" Gulfpride—and then we "launder" it, by means of the Alchlor Process. This *extra* step in refining, taken by Gulf, removes up to 20% more carbon and gum-forming impurities, and leaves an oil that exceeds every set of oil specifications—including Army and Navy. So remember, when you pour Gulfpride into your engine, you're using an oil that's been *"laundered" extra clean!*

PUZZLER FROM POLY!

As you exercise your brain over this one, you can thank Mr. Edwin C. Davis, Assistant Professor of Metallurgy at Virginia Polytechnic Institute, Blacksburg, Virginia.

A man went into a shoe store and bought a pair of shoes for $6.00. In payment he gave the clerk a bogus $20.00 bill. Not having the proper change, the clerk asked the customer to wait a moment while he went across the street to the butcher's and changed the bill. Presently he returned and gave the customer his $14.00 change. A few minutes later the butcher came over and excitedly explained that the bill he had just changed for the shoe clerk was counterfeit and demanded $20.00 in good money. The manager of the shoe store gave the butcher $20.00 in good money and he went away satisfied. The question is: How much is the shoe-store manager out?

THIS MONTH'S WHOPPER

(We're still out of breath)

Dear Major:

I'm writing you to see if you will help me out of my trouble, because I think you are at least partly to blame.

It all started when I built a beautiful gas model airplane, a model of your "Gulfhawk." This job was complete from rudder tab to inverted flight carburetor, and quite the pride of my workshop hangar. Then Local 999¼, United Amalgamated A & E Mechanics and Apprentices, decided to have a hobby show, and I entered my ship in the stunt plane class. My brother, a gun collector, persuaded me to mount a nifty little .22 machine gun (synchronized, of course) on the cowling, and we planned to practice ground strafing before the meet.

Then along comes my cousin, a bookworm par excellence, and tells me about the claims you have been making for Gulf Aviation Gas. I tell him I don't want to monkey with my tank, GAG or no GAG, but he slips a couple of drops in with the regular model gas when I'm not looking. We arm the gun, spin the stick, and off she goes, zooming over the fence at the end of the yard.

The next thing we know, she's heading for Brainard Field. In exactly .0000000134 minutes (my uncle, a watchmaker, timed her) she's out of sight. We kiss her good-by and my cousin confesses to his dastardly deed.

Soon came a C.A.A. inspector, a Connecticut Bureau of Aeronautics officer, a state cop, a city police cruiser, and a delegation of members of the Aircraft Owners and Pilots Association. I am charged with everything in the book.

It seems that the 'plane, after leaving my sight, strafed all the houses between here and Brainard (1 mile), barnstormed the hangars, caused a National Guard observer to become airsick while watching the attack, ripped the windsock from its moorings, and landed with wheels retracted on the State Capitol

grounds, ripping up the Governor's pet flower bed. The police say the mechanism tried to put the wheels down while the plane was ten miles from the Capitol, but the 'plane was going so fast that it landed before the wheels got down. The descending wheels raised the ship to a three-point position, whereupon the plane walked to the nearest Good Gulf station for a refill!

I shall appreciate anything you can do to help me, Major, but please don't make me promise to use G.A.G. in my models.

Robert J. Kirkwood

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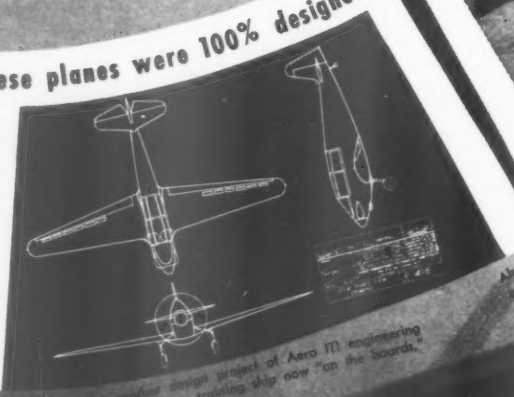

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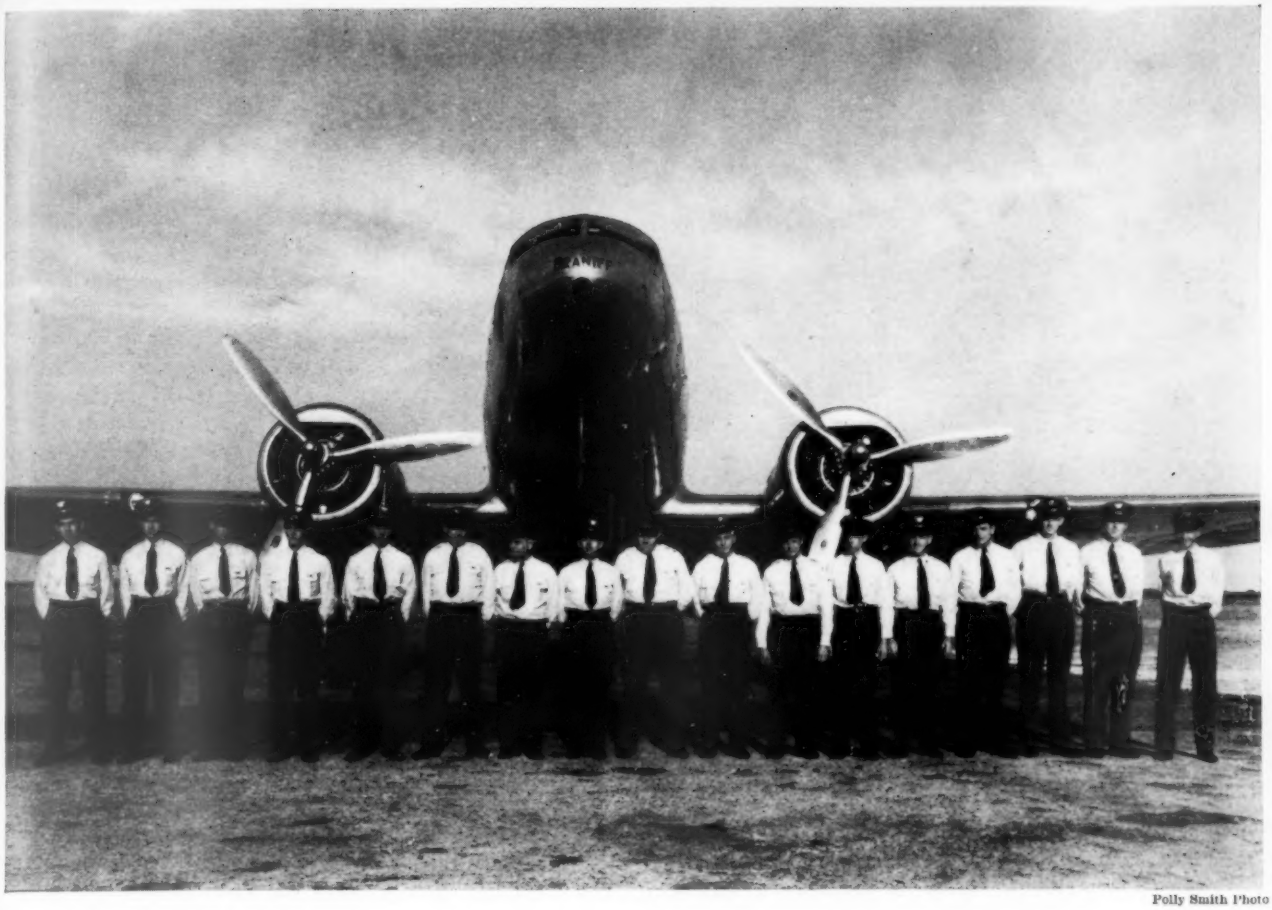

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Japan IS NOT AN AIR POWER

Above are a typical Japanese pilot and gunner. They are generally inferior in quality to those of other nations.

By LEONARD ENGEL

Because the Japanese air force has devastated helpless Chinese cities does not mean it is a potent aerial armada. Here are some cold facts.

THERE is only one considerable air force in the world about which less is known today than about the mysterious Red air fleet of the U.S.S.R. That one is the Japanese. The editors of FLYING AND POPULAR AVIATION therefore — or should I say, nevertheless—feel it a fit subject for inquiry.

Here is that it has been possible to learn about the men and planes that have been battering virtually defenseless Chinese cities day after day for nearly 3½ years. The information comes from a variety of sources, none of them public and none of them official Japanese. Tokyo doesn't talk much about anything military or economic and that silence goes double for matters aeronautic. It has not been possible to obtain up-to-the-minute figures in all cases.

Japan has two air forces—an army air corps and a naval aviation service—as does the United States, the only other major power without a unified and separate air command. At this writing the Japanese army has something under 2,500 ships of all types, including trainers; the navy, less than 500. Numerically, the Japanese forces are the smallest of the six major air fleets, whose approximate current strengths are: Germany, 25,000-30,000 planes; Great Britain, 10,000-12,000; U.S.S.R., 10,000-20,000; Italy, less than 5,000; U.S.A., about 5,000. Japanese planes are also the poorest qualitatively, but more about that later.

A year ago, the air corps had 3,000 pilots including reserves, and the navy, 2,100. Just about half of these were commissioned officers, the rest enlisted men. The Island Empire's seven army and navy air schools cannot turn out more than about 600 pilots a year. All of which, again, is small potatoes compared to the other major powers, where training commanders are accustomed to counting their yearly output in thousands instead of the hundreds.

In one respect Tokyo can claim to lead the world—namely, complexity of its governmental organizations. Even our own War and Navy Departments are put to shame in this. The organization of the Island Empire's air services is no exception to the general rule.

The basic unit, as in other countries, is the squadron, but the Japanese squadron is smaller than ordinary. Pursuit, interceptor and heavy bomber squadrons contain only 10 planes and observation

Japanese pursuit ships above are Navy Type 96 fighters generally based aboard carriers. They resemble Boeings.

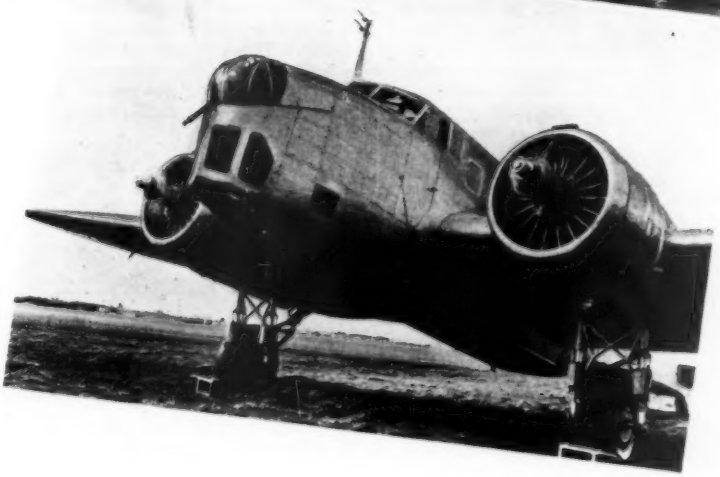
and light bomber, only nine. (The usual bomber squadron in other countries contains a dozen ships plus a spare; the fighter squadron, 18 warcraft.)

Japan has 106 combat squadrons altogether of which some 35 are pursuit and the rest are divided equally among light and heavy bombardment and observation. Total combat machines: about 1,000. About one-fourth of the Japanese air corps is based on Manchuria, part of the huge garrison (300,000 men, the crack Kwantung army, best of the Island Empire's forces) so far immobilized north of China by Tokyo-Moscow mistrust. Another quarter is in Central China, a sixth in North China and a quarter—mostly pursuit and scouting—is in Japan itself.

Here is where the organization begins to get dizzy. In the first place, a squadron is not necessarily made up of the same type of planes. It is not unusual to find observation and bombing craft in the same squadron.

Squadrons are grouped into "air regiments." An air regiment is supposed to contain four squadrons, but in practice the number ranges from two to five. It is most unusual to find all the squadrons in a regiment—which corresponds roughly, very roughly indeed, to the American group and the British wing—made up of the same type of plane.

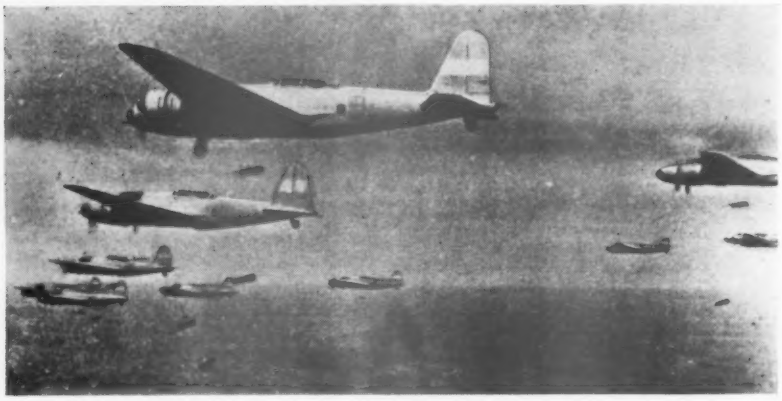
Air units stationed in China are under the army commanders in charge in the particular area in which they operate; Manchuria-based ships are directed by the Kwantung army staff from its headquarters at Dairen, the big Japanese port wrested from Czarist Russia 35 years ago. Squadrons in Japan proper, Corea (first Japanese mainland colony, "annexed" in



Biplane at upper right is Army Type 94 reconnaissance machine now used in China.

Center right is single-engined Navy 96 carrier-based bomber now with the fleet.

Currently used by Japanese are Italian Fiat bombers like BR-20 directly right.



Big bombs dropping from the above Japanese twin-engined bombers are headed for a Chinese city. These ships look like a small version of the Boeing "Flying Fortress."

A standard trainer type is the Army 95-1 single-engined biplane above. New pilots for Japanese Army and Navy air forces can only be turned out at a rate of 600 yearly.

1910) and the island of Formosa make up a G.H.Q. air force. This is divided into three wings. The biggest, of four regiments, is in Japan itself; two-regiment wings are in Corea and Formosa.

The inadequacy of the Island Empire's air corps in numbers by western standards is even more striking in the case of the naval air service, although only when the latter is contrasted with its only possible naval opponent: the United States. Naval aviation, in general, is limited by the capacity of a navy's ships to carry warplanes. At first sight, the Japanese seem to be well off: seven aircraft carriers—more than either the United States or Great Britain has—are in commission. But here the equality ends. Japanese carriers, surface ship for surface ship, are inferior to the British. And the British are far inferior to the American.

The six American carriers can handle about 600 planes under wartime conditions; their peacetime complement is 450. British carriers have a total capacity of 250. The Japanese capacity is even smaller. The fact is that American naval designers build better carriers than the British—and the British, better than the Japanese.

Three of the Japanese carriers are brand new 10,050-ton sister ships: the *Soryu*, *Hiryu* and *Syokaku*. The *Syokaku* was placed in commission only late this summer. These three can each carry about 30 planes. For purposes of comparison, Uncle Sam's newest are the *Enterprise*, *Yorktown* and *Hornet*, of which the *Hornet* is still building. The American vessels are 20,000-tonners with a peacetime complement of four squadrons (72 planes) and a wartime capacity of about 100. The greater American capacity is due not only to their larger size, but to better utilization of space and the ability of American manufacturers to turn out smaller planes still able to meet the rigorous requirements of sea duty.

The biggest Japanese carriers are the *Kaga*, a 27,000-tonner originally laid down as a 39,000-ton battleship and altered following the 1921 naval limitation treaty among Great Britain, France, the United States, Japan and Italy; and the *Akagi*, also a 27,000-tonner. The *Akagi* started life as a 42,000-ton battle cruiser.

The *Kaga* and *Akagi* carry 30 planes apiece normally, but can handle as many as 50. The *Akagi* would be able to handle more if the Japanese had run the flight deck the length of the ship and used the space beneath it for hangars. But so far, only American designers seem willing to go in for overhangs and the like.

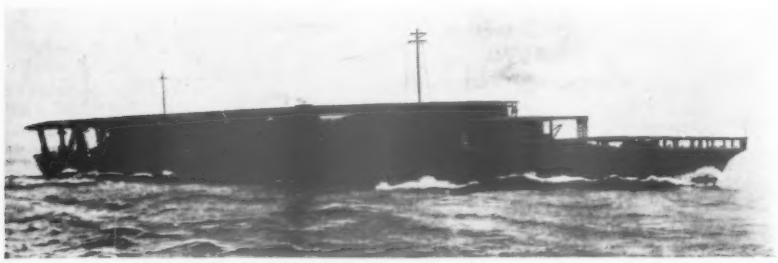
The other Japanese carriers are small and slow (speed is essential to a carrier because it is such a vulnerable ship; it takes only a couple of bomb or shell hits to wreck the flight deck). They are the *Ryuzyo* and *Hosyo*, about 7,000 tons and 20 planes each. Speed: 25 knots. Carriers should do 30 knots or more. Three new carriers are under construction but will not be ready for at least two years.

Including shore-based seaplanes and flying boats, the naval air service had in commission, just before the outbreak of war in Europe about 100 fighters, 150 torpedo bombers and 75 heavy bombers (which are not comparable to our own patrol flying boats, but which are not ship-based craft). It has been only in the last year that the Japanese navy has completed installation of catapults on its battleships and cruisers to launch spotting planes.

If relatively little is known about the numbers and distribution of Tokyo's air arms, even less is known of the ships they employ—except that they are not big league in quality or performance. Fortunately, however, the Japanese have a curious numbering system which enables the outsider to make a pretty good guess at the caliber of Japanese warcraft.

Models produced originally in Japan in 1935 are known as Type 95: for example, Type 95 pursuit and Type 95-1, 95-2 and 95-3 trainers. Ships produced in 1936 are Type 96; in 1937, Type 97. There are Type 97 observation, pursuit, light and heavy bombardment planes. Now it happens that Type 97 models, produced in 1937, are no better than 1935 models developed in Europe and the United States. Japan was thus at least two years behind the parade two years ago (the 97 series of models did not go into service until 1938, of course). Despite Herculean efforts to catch up, the Japanese are undoubtedly further behind today. The stimuli of war in Europe and the armament program in the United States have boosted air performance in the west way beyond levels attainable in Japan.

(*Continued on page* 70)



One of Japan's biggest aircraft carriers is the "Akagi." It displaces 27,000 tons, carries 30 planes but could handle more if its flight deck extended ship's length.

Bergen and McCarthy recently flew out to March Field where Charlie was made an honorary sergeant.

Flying Funnyman

by EDWARD CHURCHILL

Edgar Bergen is famed only as a ventriloquist, yet the aviation industry could use a hundred like him. He is an air-minded gentleman with plenty of ideas.

STANDING on the line between a long, squat row of hangars at the north side of Grand Central Air Terminal, in Glendale, is a trim yellow plane. It is probably the neatest plane on the narrow field. It looks as if it just rolled off the assembly line. It is almost neater than Wally Beery's green Howard, which is really something.

The plane is a Stinson "105", 80 h.p., 1940 model. It has a radio receiver with a very precise aerial. It has a self-starter. It has a generator. But probably the most interesting thing about this yellow job with the black trim is that it has a circle on the door. A black circle. Inside the circle is the silhouette of a very famous guy in a high silk hat. The lad wears a monocle.

The story's out. Our friend is Charlie McCarthy. He's on the Stinson because the Stinson belongs to that precise, very diffident man, Charlie's boss—Edgar Bergen. Bergen already has flown the ship some 35 hours, including a cross-country trek from the factory at Nashville, Tenn.

"I like airplanes," Bergen told me, as I delayed a sunset take-off for the purpose of getting in some time, "because I like mechanical perfection. I like anything that is machinery. An airplane is just about the ultimate in machinery.

"I like flying because it means freedom from nervous strain. It means relaxation. I can get all tangled up in a radio script, plans for a motion picture and six other jobs. Then I can take off and forget about everything for a little while. I come down with a clear head."

That's part of the reason. Bergen is nuts about engines, airplanes and the people who fly them. Furthermore, he's fascinated by the very fact that he's able to fly. Even after 50 hours he has moments when it doesn't seem quite possible to him that a dream he's always had could come true—that he not only owns his own ship, but that he's as much boss of it as he is of Charlie McCarthy.

Bergen is important to aviation not for any of the above catalogued reasons, either expressed or unexpressed. He's not just another aviator. He's not just a guy with 50 hours. Bergen is strictly a gentleman with ideas—and that's why he's important just now.

Bergen is known as a ventriloquist. He's known as a motion picture actor, a

(*Continued on page* 62)

FIXED GUNS vs. FREE

One of Britain's deadliest warplanes is the Blackburn "Roc" with four-gun turret.

BRITISH COMBINE

by ROBERT A. WINSTON

Heavy armament is the backbone of Europe's war in the air. A major problem in future development is the decision between movable and fixed plane guns.

NOT very many moons ago, the world's aviation experts were unanimously proclaiming the end of the fighter era. "The fighting plane is obsolete," they announced with pontifical finality. "The advent of the modern high-speed bomber has ended the day of the dogfight. From now on, invincible armadas of bombers will rule the air."

This edict, it appears, was a bit premature. The experts were making the fatal mistake of comparing *horizontal* speeds. "If we have a bomber that is 50 m.p.h. faster than the enemy's fighters," they reasoned, "the bombers will be able to outrun the fighters."

This is quite true as far as it goes, but there are several other factors to be taken into consideration. The first is that the mission of the bomber is offense. For this reason it is not always necessary for the fighters to be able to outrun the bombers. If the fighters are waiting between the bombers and their objective, as is usually the case, the superior speed of the bombers usually brings on the real showdown that much faster.

All things considered, the fighter's task is simple compared with the horizontal bomber's assignment. The bomber's most vulnerable moment is just when it is closest to accomplishing its mission. In order to get hits, the horizontal bomber must be flying straight and level long enough for the man at the bombsight to get his aim. At this stage the bombing plane must not deviate from its course, or its bombs will miss. The pilot is busy making a smooth "run," the bombardier is lying flat on his stomach with his eye glued to the bombsight and both hands full of adjusting knobs correcting for altitude and drift. Only the rear gunner is protecting the plane.

At such a time, the bomber is dead meat for the average fighting plane, even if the fighter is slower. If the fighter is waiting

ACME

Almost any modern fighter, like the British Hawker "Hurricane" above, has the advantage of superior fire power. The "Hurricane," like the famed "Spitfire," is armed with eight .30 caliber guns (circles).

at the same altitude he can meet the bomber head-on. In this case, the fighter's objective is accomplished, for the bomber's run is spoiled. The man at the bombsight must drop his vital work of directing the bomber's course to that pinpoint in the sky where his plane must be at a certain precise second in order to get hits. He must pick up his machine gun and defend himself for, in his exposed position out in the transparent nose of the bomber, he is the most vulnerable of any of its crew. The pilot of almost any kind of airplane flying directly at him would be able to spoil his aim—even in a Curtiss pusher with only an armful of bricks for ammunition.

Remember that the *only* place the bombs can be released on any given run is in a direct line from the nose of the bomber to its objective. If the bomber is flying in a slight skid, or if the bombs are released half a second early or late, they will miss the target by hundreds of yards. Thus any obstacle in the bomber's path must be removed once the aiming approach is begun, or the bomber must circle and come back for another try. And if enough defending fighters are sniping at him, the pilot may give it up as a bad job, jettison his valuable cargo of bombs at random and head for home. At this point he may be able to outrun the fighters—*if* they do not have an altitude advantage. If they happen to be at a higher level, the bomber may still be out of luck, for a diving fighter can quickly convert an altitude advantage into sufficient air speed for overtaking the fastest bomber.

When this occurs it is a duel between fixed guns and free guns. Here the fighter with its fixed guns has a definite advantage over the free-swinging guns of the bomber. Almost any sort of fighter used today will have the advantage of superior firepower, with at least four machine guns and sometimes as many as eight. In addition, the fighter is a fairly small target while the bomber is a big target which can be put out of commission if the pilot, bombardier, or engines are hit.

The fighter pilot can shoot comfortably from almost any position. Even if his plane is banked steeply, upside down, diving or zooming vertically, all he has to do is press his thumb on an electric trigger button when the bomber enters the field of his gunsight. He can change his position instantly by leaning one way or the other, ducking under the bomber's tail or wing, or diving at it with the sun behind him to blind the rear gunner. The bomber's free guns are definitely limited in radius of action. It is very difficult to shoot free guns straight up or directly astern, which are the fighter pilot's favorite approaches. Also, the free gunner has to swing his guns in order to train them, where the fighter pilot does not. Even if the free gunner has a power-operated turret, the fighter pilot still has a much easier job of aiming his guns. The power turret cuts down the fighter's advantage, but does not nullify it. If two fighters try for the bomber, one will probably get it even if the other is shot down—and fighters usually attack in groups.

Various formations of bombers have been tried out in an attempt at mutual protection against fighters. In the recent Russo-Finnish war the Russian bombers started out with large flights of 70 or 80 bombers in massed V of V formations. These bombers, copies of our Martin and Douglas types manufactured under Russian license, were faster than the Finnish fighters which were "obsolete" Fokkers equipped with fixed

(*Continued on page 79*)

Robert A. Winston, the author, was photographed in cockpit of a Finnish Brewster.

CONTROLS, *Unlimited*

HOWARD AIRCRAFT

The white outlines indicate typical installations of Arens controls on the dashboard of a cabin monoplane.

by NICHOLAS N. PLASTERER

Most remote controls for aircraft come from the small Chicago factory of "Slim" Arens, a shy engineer who got his start in aviation building model airplanes.

THREE decades ago a tall, gangling youth of 14 began dabbling with model airplanes when off duty from his work in a railroad office. Today he is president of a Chicago airplane controls factory. Though his plant is not large, Charles A. Arens plays an important role in modern aviation. Equipment manufactured by Arens Controls, Inc., is used in all types of aircraft.

If you have looked at an instrument panel, undoubtedly you have seen one or more Arens remote controls. If you are a pilot, chances are you have operated several of them. The patented Arens control solves the problem of push-pull manipulations "around a bend," from propeller diving brake lock to dump valve of the fuel system; from fire emergency valve to landing light. The 10 types of Arens controls—all of them approved by the CAA—are adaptable to dozens of other uses.

Airplane builders have found "going around a bend" a major problem in installing controls. Various obstructions may be in direct line between the dashboard and the part to be operated. For example, the oil or gas tank may lie directly between the carburetor and the dashboard control for throttle or mixture. Arens controls make it a simple manner to skirt around such obstructions. Although several other companies are making similar controls, Arens produces the largest share of them and he also has the biggest assortment. Before Charlie Arens came along there were two ways of going around a bend. One was a series of rods and bell-cranks, or jointed devices, at each turn of direction. There was at least some play at the joints and they needed servicing. The other method was the use of two cables for making adjustments in the two directions. Both of these methods require more room than is used by the Arens control. It is almost impossible to use any control other than the Arens type in some installations because of lack of space.

The principle of the Arens controls is simple. The rigid type has a brass tube enclosing the flexible mechanism which connects the knob on the instrument panel with the unit to be operated. The connection is a spring of coiled wire for the push or compression load, encircling a cable for the pull or tension load. The control can be used with the various dash units (plain, locking and vernier) and resembles the choke on an automobile dashboard. The all-flexible type control has the spring and cable operating inside a flat wire coiled, fabric-braided casing, which is treated to resist gasoline, oil and water. A third type is a combination of the rigid and all-flexible models. The all-flexible, rigid and combination controls are used for throttle, mixture, spark, cabin air, oil cooler, carburetor air, flap position indicator, landing position indicator and propeller adjustment.

Arens products also include the vernier-type control which may be used in conjunction with a rigid, all-flexible or combination model. With this control, coarse adjustment is made by pushing and pulling the knob and fine adjustment by turning the knob. It is useful when fine adjustments of the throttle, mixture, carburetor air or propeller are to be made. Another Arens

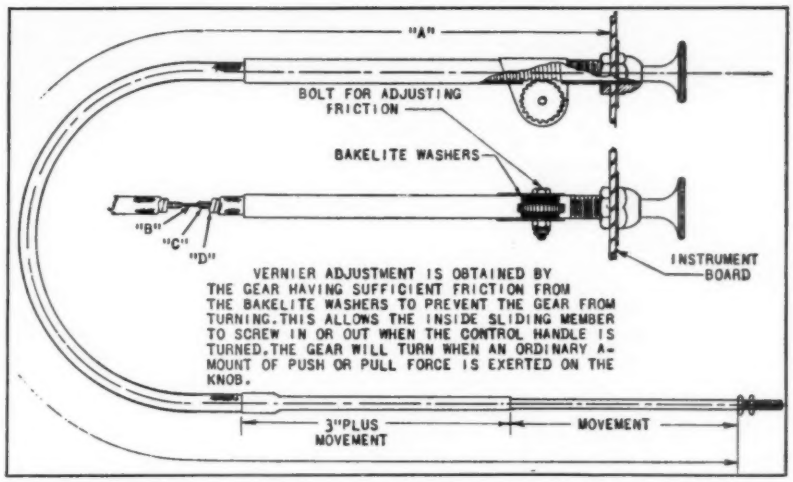
item is the rotating push-pull unit, with which any degree of rotation up to or more than 360° can be obtained. It is a new Arens development and its present use is limited to adjustable propeller valves. The device converts the push-pull movement to a rotary movement. A tightly coiled spring is attached to both ends of the sliding member, a loop of the spring encircles the pulley holding the pulley and sliding member in position.

One of the firm's featured products is a locking device used in aircraft and other fields. By means of a steel ball and a hardened wedge, the controls can be locked in any position. Among the controls which often employ the lock unit are those for the carburetor air scoop, oil cooler, cabin air control and parking brake.

Many aircraft manufacturers use Arens controls as standard equipment. The Howard Aircraft Corporation installs seven of the controls on its planes: for throttle, propeller, wobble pump, parking brake, mixture, cabin ventilator and carburetor air. Conflicts abroad and defense measures at home have resulted in a substantially increased demand for Arens controls. Lockheed is Arens' largest customer; the hundreds of Lockheed *Hudsons* being used by Britain's Royal Air Force carry Arens controls. Martins, Grummans and Brewsters exported for war service have Arens' controls. A large number of controls used in ground and aerial warfare are produced by Arens Controls, Ltd., at Croydon, England. This affiliated firm was licensed 10 years ago to manufacture them.

Many of the military aircraft bought by the U. S. Government are equipped with Arens controls.

The adaptability of Arens controls to aviation is shown in a listing of 40 different applications in which they have been used on military and Naval aircraft alone. The controls are used for the master switch, starter switch, mixture, throttle, spark, carburetor pre-heater and carburetor air scoop. They are also employed to operate the regulator and vent cut-off and the dump valve of the fuel system. If a pilot wants to flatten the propeller pitch to develop full horsepower for take-off, an Arens control will do the trick. After altitude has been gained, the control will enable him to steepen the pitch, so that the prop takes a bigger bite, lightening the load on the engine.


"A"
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"B"
"C"
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VERNIER ADJUSTMENT IS OBTAINED BY THE GEAR HAVING SUFFICIENT FRICTION FROM THE BAKELITE WASHERS TO PREVENT THE GEAR FROM TURNING. THIS ALLOWS THE INSIDE SLIDING MEMBER TO SCREW IN OR OUT WHEN THE CONTROL HANDLE IS TURNED. THE GEAR WILL TURN WHEN AN ORDINARY AMOUNT OF PUSH OR PULL FORCE IS EXERTED ON THE KNOB.
3" PLUS MOVEMENT
MOVEMENT

A typical Arens control is the around-a-bend remote control illustrated in the above blueprint drawing. Similar controls also are installed on tanks and boats.

On an Army reconnaissance flight it probably is an Arens control that operates the camera door. The bomb safety and bomb release of a bomber also are manipulated by one of Charlie Arens' devices. The controls figure in the comfort of the pilot and his crew, one of the models being used for the heating and ventilating system. Communications may depend upon an Arens unit used for the radio receiver band. When the plane returns to the airport the landing light may be operated by an Arens control. Before the pilot leaves his ship he will set the parking brake—also one of Arens' products.

Other military and Naval uses of Arens controls operate propeller diving brake lock, throw-out control, throttle unit, engine control shutter, flap control, supercharger, wobble pump, instrument by-pass valve, pilot-seat locking device, cockpit heater, deicer, engine cowl flap, fire emergency valve, release cable for pressure fire extinguisher, gyro-pilot, stabilizer incidence indicator, oil shut-off valve, hot air intake, flap position indicator, battery cut-out switch, oil radiator control, landing gear indicator, auxiliary tank pump control of the oil system and oil cooler shutter. In addition to aircraft and marine controls, the Arens firm now is furnishing equipment for other fields. One of its recent assignments was the production of controls for Admiral Byrd's Antarctic Snow Cruiser. The longest remote control necessary for this huge vehicle measured 60 feet.

Arens says: "We are working on some new ideas which we believe will be of advantage to the aircraft industry. Our business in the past was chiefly with the aircraft manufacturers and airlines, but we are now branching out and are furnishing controls for various other uses such as air conditioning, automotive, marine and industrial." Marine controls include throttle, mixture and spark units for everything from small outboards to crash boats. Arens provides furnace and ventilator controls for air conditioning. The flexible con-

Cal Norton (left) joined Arens (right) a year ago as vice president-secretary.

From this stock room comes control supplies for Britain's Lockheed "Hudson" bombers.

Arens machinists currently are turning out from 700 to 1,000 finished controls weekly.

trol, with or without the locking device, also is used in air conditioning. Throttle controls also are found on a number of commercial and fire trucks.

Behind this scientific development in the Chicago factory is the same enthusiasm for aviation that Arens showed in his model airplane days. Informal, he works in office or back shop with his coat off, shirt sleeves rolled up. Back in the plant when his employes greet him, it is either "Charlie" or "Slim" (he stands 6 ft. 3½ in.). His workers are loyal and have high respect for him, but are not expected to hold him in awe.

Arens is a native of Chicago where he attended grammar school. He was working for the Rock Island Railroad as office boy and later as a clerk when he started to build model planes in 1911. In 1912, when he was 16, he became one of the Illinois Model Air Club's first members. He flew his models at the famous old Cicero flying field. The air club was founded by William Stout who later designed the Ford-Stout trimotor monoplane and who now heads the Stout Engineering Company of Dearborn, Mich. Arens incidentally, built controls for the throttle, spark and mixture on the Stout all-metal planes. At the Cicero field he also helped the pilots and mechanics. More important, he had the opportunity of helping Matty Laird build the first Laird airplane. Laird took Arens and the late George "Buck" Weaver with him as mechanics on his first exhibition flight in 1915.

The exhibition flight was made at a county fair at Alliance, O. The plane was crated at Chicago and shipped to Alliance where it was reassembled for the show. Laird's finances were so low that his two mechanics had to pay their own railroad fare. However, he was able to reimburse them. The fair paid Laird $300 or $400 for the two flights he made. Each consisted of a short trip over the city and several circles over the fair grounds several times. Weaver later founded the Weaver Aircraft Company. Laird now heads the E. M. Laird Airplane Company of Chicago.

His appetite for aviation increasingly whetted by his association with Laird and other pilots, young Charlie started to build a small biplane in the fall of 1915, using a three-cylinder Anzani engine. Finishing it in 1916, the 20-year-old builder took his plane to Ashburn field. Matty Laird tested the ship and Charlie hopped it that fall. It was the only plane he has ever owned. Accordingly he became a member of the Early Birds by soloing before December 17, 1916.

Charlie never has held a pilot's license nor did he make another flight as pilot after that lone trip in his own plane. But he still holds Aircraft and Engine Mechanic License No. 240, issued July 14, 1927. In the spring of 1917 just before the United States declared war, he sold his plane for $400 to Horace Keane who used it as a solo ship in a private airplane school on Long Island. Before Keane bought the plane it was flown by Marjorie Stinson, Bert Acosta and Laird. By the time Charlie had hopped his plane he was unable to retain interest in his railroad office job.

"There was no alternative," he laughs. "I was eating, sleeping and dreaming aviation and I don't imagine I was worth much in the railroad office. So in December, 1916, I quit my job and went to Long Island where I had a chance to be a mechanic with the L. W. F. Engineering Company. Later I also served as inspector.

"As a mechanic I worked on assembly in the experimental department and also did considerable field work, set up planes and rode as a mechanic on test hops. I helped build the first Liberty-motored plane. The first few Libertys had eight cylinders but they soon switched to 12-cylinder engines. These biplanes were built as observation planes for the Army. The Army furnished the engines and we built the planes. I also worked and flew as mechanic on the L. W. F. *Owl*, also built for the United States Government. It used three 12-cylinder Liberty engines and was the largest plane the Government had at that time."

During his 7½ years with the L. W. F. plant, Arens developed his inventive ability. He worked on many special jobs, one of which was a motor test stand. He was asked to install a throttle control on the stand. That was the actual start of Arens Controls, Inc. His first control consisted of a steel casing bent to the required shape with a spring for compression encircling a cable for tension—the same principle used in controls now produced in the Arens factory. Returning to Chicago, he worked for Matty Laird as mechanic. In 1926 he became a mechanic for the newly established Chicago-Minneapolis air mail line, owned by the late Charles Dickinson, "father of aviation in Illinois." Arens was employed by the airline only a few months when Dickinson sold out to Northwest Airlines.

This is Charlie Arens beside his first and only plane. The date: November, 1916.

Meanwhile, Arens continued to produce his controls in a basement shop at home, filling many small orders. Finally he devoted full time to production. One of the planes he equipped with controls during this period was Billy Brock's Stinson which he flew most of the way around the world in 1928. Brock, accompanied by Ed Schlee, flew from New York to Tokyo via London and Paris, traveling from Tokyo to the United States by boat. Brock's plane was equipped with Arens controls for the throttle and mixture.

With the demand for his controls growing Arens in 1929 licensed the Wilson Steel & Wire Company of Chicago to build the controls on a five-year contract, the inventor to serve as manager of the department. At the expiration of the contract in 1934 Arens opened his own plant. From three or four employees in 1934 his staff increased to nine by July, 1939, when the firm was incorporated under Illinois statute as Arens Controls, Inc. In October the concern moved to larger quarters and more equipment and machinery were bought. Thirty employees now are working for the firm.

The present plant has about 6,500 square feet of floor space, but Arens is planning to expand. The factory is located on the sixth floor of a factory building at 2253 S. Halsted St. In other floors of the building several small factories produce a variety of products, including medical supplies, metal beds and bed springs, dresses, cotton felt and furniture. Before the first of the year Arens plans to take over the entire sixth floor. This will give the plant a total floor space of 10,000 square feet. Since the office will remain unchanged and there will be but slight enlargement of the stock room, the change will double the plant's actual production space.

Orders are pouring in from all sections of the United States and there are also several Canadian accounts. The Arens factory now has a backlog of more than 7,000 controls. Under present production the plant is able to turn out from several hundred to 1,000 controls a week according to the type.

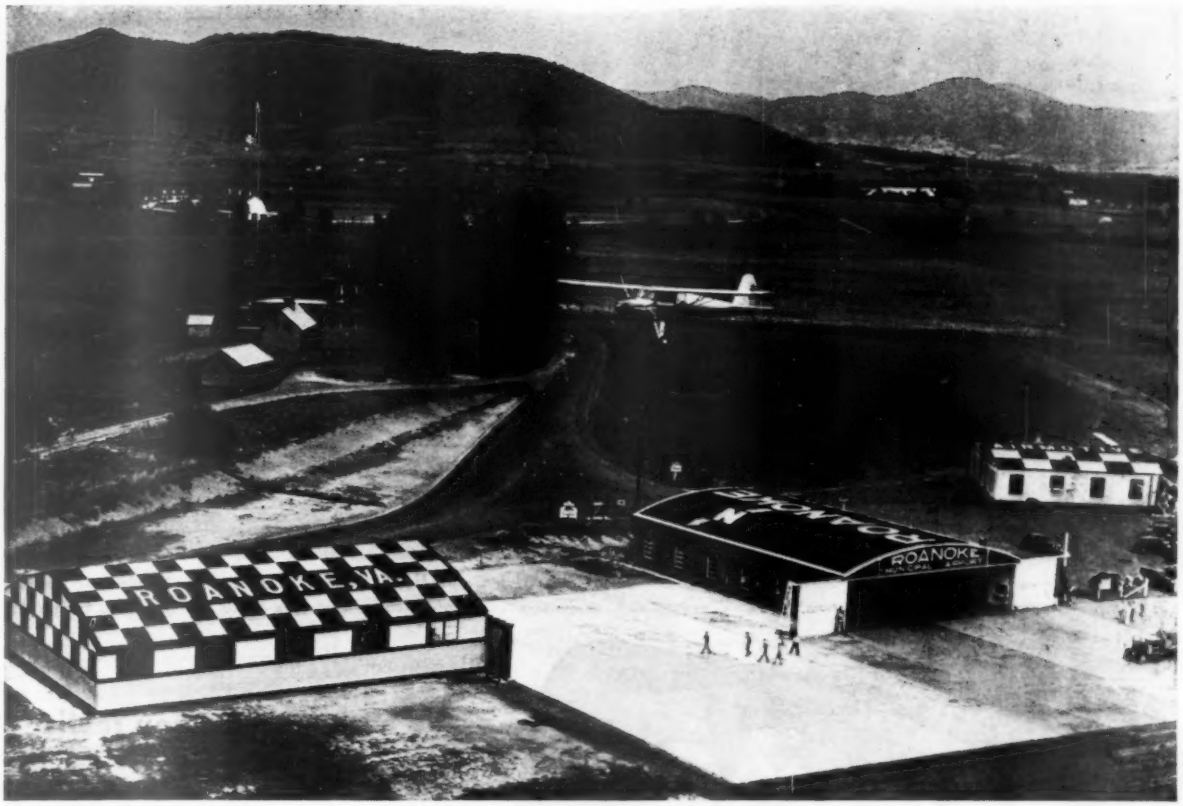
Four years ago Charlie Arens had $28 in the bank; today the company has an authorized capital of $50,000. For the first quarter of this year gross business was over $18,000. Comparative gross incomes for the past five years show the factory's steady progress. In 1935 the gross was about $10,000; 1936, $14,000; 1937, $25,000; 1938, $25,000; 1939, $42,000. Gross for 1940 will total approximately $80,000.

Arens is not only president and treasurer, but also chief engineer. Lack of technical education has been no handicap. His is the knowledge derived from years of experience, bolstered by keen powers of observation. Ingenuity and practicability have been combined to produce his inventions. An idea for a new development comes to him and he works out its general principles in his mind. Then he experiments until he is satisfied with the results. Explaining his bachelor status, Arens says: "I've never had time to get married. I doubt if any wife would stand for me spending so much time at the shop."

A new member joined the firm when it was incorporated last year. He is Calhoun Norton, vice president and secretary. He has relieved Arens of much of the responsibility of operation, giving the latter more time to push expansion of the plant and work out new developments. President Arens and Vice President Norton make an excellent team. Aged 44 and 25, respectively, they typify the youth of aviation.

Norton was born in Chicago where he

(*Continued on page* 66)



Roanoke's municipal airport currently handles 30 planes, 526 pilots and 10 commercial operators.

AIRPORT IN THE BLUE

by EDWARD S. MARSHALL

A persevering airport manager staked his future on his city's importance to aviation—and put Roanoke, Va., on the airways map permanently.

R. J. Dunahoe

A STRANGER flying along Green Airway No. 4 would notice nothing unusual about the 300 acre airport spread flatly between Roanoke, Va., on one side and the Blue Ridge mountains on the other. But of the approximately 600 municipally owned and operated airports lacking airline service, only an average of 15 have reported a net operating profit in recent years. Figures for 1939 are still incomplete, but standing out among that exclusive half-a-handful which steered clear of the red will be Roanoke's municipal airport.

Like many another enterprise that has succeeded with the odds stacked against it, Roanoke's achievement can be credited primarily to the efforts and ability of one man —Airport Manager Robert J. Dunahoe.

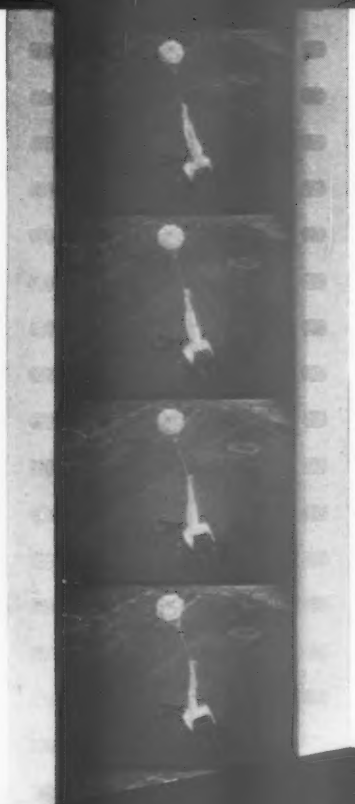
At the beginning of 1937 when the Roanoke city fathers discontinued the leasing of the airport and placed a manager on the municipal pay roll, the field was in a decidedly anemic condition. The lessees had agreed to pay the city a monthly rental of $75. At the time of the changeover not a penny was being received. The two runways totaled a scant 900 feet of hard surface. There was a single hangar. One commercial operator struggled for existence. There were but 53 pilots and only nine airplanes.

By the end of June, 1940—3½ years after Bob Dunahoe took over—a check-up showed 3,000 feet of graded east-west runway, 1,500 feet of which is hard surfaced to a width of 100 feet; a 2,500 foot north-south runway, surfaced for a distance of 1,950 feet and 100 feet wide; two hangars, an additional 16,000 square feet of concrete apron; 10 commercial operators, 30 airplanes—15 of which are operated commercially; 318 pilots, not including 208 fledglings taking flight instruction.

On the northeast edge of the airport has been built the big Virginia Airmotive aircraft overhaul and repair shop. Between it and the hangars is the CAA airways communications and weather station. To complete the reversal of the picture, at the end of 1939 the airport paid the city of Roanoke $600, representing the net profit figure for the year.

Sitting at his scarred desk in a partitioned-off end of No. 1 hangar can usually be found the man who is responsible for swinging Roanoke's airport out of the red into the blue. Robert J. Dunahoe looks like what he is—a sunburned business-man-pilot whose job is his hobby. For, as Bob himself admits, he literally eats, lives and sleeps aviation. He even spends his vacation flying into other fields in search of ideas.

(*Continued on page* 58)



Movie Soldiers

by Alexander McSurely

Capt. C. J. Crane (left), co-inventor of Air Corps automatic landing system, checks story technicalities with Head Animator Bob Fitzgerald.

PHOTOGRAPHS BY JAMES N. KEEN

Whether or not you realize it, the Army Air Corps is in the motion picture production business and has been for years. But few civilians see the films.

Air Corps moviemen film the new Douglas B-23 in action.

Aloft in a Martin B-10B bomber, Cameraman Ed Andres shoots aerial scenes through a side port while Sound Technician V. J. Svancara directs pilot by interphone.

Capt. John Fite, director of Air Corps motion picture unit, recites narrative for sound recording.

A BIG Army bomber roars through the clouds on the screen before your eyes, suddenly folds its wings under its nose and goes to sleep on a cloud after several preliminary stretches and yawns.

Fantastic, but there it is; all accomplished by the tricky pens of Wright Field's motion picture studio animators and the clever photography of Air Corps movie cameramen. While the big plane slumbers on and even snores a bit, the voice of a commentator describes the technique involved in the Air Corps automatic landing system.

You see, the bed of clouds really is part of an overcast and the bomber is stuck up above it, unable to get through to a safe landing. It can only wait and hope for a break in the clouds.

But to end the suspense: the film finally lands the bomber by using the intricate system of interlocking radio controls developed at Wright Field, which recently won for the Air Corps the Mackay Trophy.

The animated drawings and the narrator's explanation make the system of automatic controls, each adjusting the ship's angle of descent and dropping it to a selected level at a selected distance from the landing field, seem altogether relatively simple. Few civilian eyes outside the Air Corps ever will view this film or the other technical motion pictures prepared by the motion picture branch at Wright Field, Dayton, O. For they are not produced for public edification or amusement, but to instruct Air Corps personnel in various technical procedures.

Not all Wright Field movie productions, however, fall in this technical classification. Captain John Fite, movie lab chief, and his staff have just completed "Wings of the Army," an historical film that will be of interest to every student of aviation and which is being released generally. The picture starts with actual scenes of the tests of the first Army plane purchased from the Wright brothers and brings the story of the Army's fighting ships down to the newest experimental ships being tested by Uncle Sam for the current Air Corps expansion program.

Prints of this film are being sent to every Air Corps post in the country, and may be obtained free for showings before luncheon clubs, civic organizations and the like by applying to these posts. One of the principal values of the film is in its authenticity. Virtually all its historical chronicling of developments and famous flights of the old Army Air Service and the newer Air Corps are actual scenes taken at the time when those developments and flights were made. Those old pictures of the Wrights testing the first Army plane at Ft. Myers, Va., in 1908, are a little jerky and fuzzy, but they still are remarkably clear. You see Orville Wright leap to his seat in the clumsy box-kite alongside Lieut. Ben Foulois, and watch the unwieldy craft slide down the monorail for its takeoff. You even get a glimpse of President Taft who comes over from Washington to see the Wrights and their flying machine.

There's a glimpse of the first non-stop flight across America, made by Macready and Kelly in the old Army Fokker T-2. You see the start of the first 'round-the-world flight, by the three Douglas cruisers and the *Question Mark* on its refueling-record flight. The procession of famous flights and developments moves on and you see more modern experiments, including shots of the stratosphere balloon expedition of Capts. A. W. Stevens and Orval A. Anderson, for the world's absolute altitude record. You see flight tests of oppositely rotating propellers which experts believe may become standard on high-speed planes within the next two years. These are a few of the highlights of the picture, which has other historical film records of aviation outdistanced for authenticity, since the various scenes are actual movie records of the developments portrayed.

Yet another phase of the movie lab's work is the making of technical records of experimental tests in the great Air Corps proving laboratories at Wright Field. For example, a test may be made of the strength of a new wing or airplane fuselage in the structures laboratory. It is of great importance for the engineers to know the weakest point of the structure—the point where the wing or fuselage will fail first when an overload is imposed. So they pile on the carefully measured load while high speed movie cameras record the process. When the break begins, the movie camera "stops" the failure at the very beginning showing the first tiny crack far more accurately than the keenest eye. Some results are recorded with cameras which can take 2,200 pictures a second.

Flight performance tests of new Army airplanes brought to Wright Field also are recorded by motion picture cameras. The plane travels over a special marked course and goes through its paces while the camera records the performance by spotting the plane in relation to markers on the course and simultaneously recording the time. *(Also see* FLYING AND POPULAR AVIATION, *July, 1940.—Ed.)*

The Air Corps movie lab provides Army recruiting offices with films of Air Corps life, showing training scenes at Randolph Field and activities of various tactical units. It is likely that this particular phase of its work will be increased within the next few months. A new film about the flying cadet's life at Randolph Field is now being completed for general release as recruiting material.

Another phase of the movie lab's work is the making of film-slides for Air Corps schools. Photographers make a series of still pictures on movie film, to be projected through a device which stops each picture on the screen. An explanatory narration to accompany the series of pic-

Rough sketches of action to be shown in technical cartoon are posted on wall for guide to drawings.

Juanita Black, artist in animation studio of Air Corps motion picture unit, sketches a Douglas B-18 bomber from an exact scale model of the original ship.

tures is recorded on a disc record. When the comment for one picture is finished the record rings a bell as a signal to the projectionist that it is time to show the next picture.

Most colorful figure in the laboratory is the veteran civilian chief, L. C. Hagemeyer, who has an unequalled background in aerial motion picture photography. He has been making aerial movies since the unit was originated back at old McCook Field in 1920; he had some movie experience in the World War before that.

It was in those early days when Hagemeyer, like most aviation pioneers, had his most exciting experiences, before air safety became the reality that it is today. If you get to know him well, you may get him to tell you about some of them. . . .

There was that time at McCook Field in 1920 when he was making motion pictures of machine gun fire from an early Martin bomber plane. The gunner was in the rear cockpit and "Hagey" had his camera tripod anchored on a platform in the nose of the plane. The platform originally had been intended for an aerial cannon mount but it proved ideal for camera work—or so he thought.

The lumbering old craft took off with "Hagey" on the platform, without any straps to hold him on. He had no parachute; those were the days before they were generally accepted. Suddenly the bomber lurched and Hagemeyer's feet slipped off the platform. He clutched wildly, grasped the legs of the tripod and dangled at arm's length for what seemed like hours before he managed to pull himself back up. The pilot, horror-stricken to see Hagemeyer drop out of sight, had already "written him off for a dead pigeon," according to the story.

About a year later—in 1921—"Hagey" was up in an Army blimp to film the aerial bombing of two old German battleships off Cape Charles, Va. They were flying about 75 miles off the coast when a sudden storm forced the big gas bag lower and lower until the gondola rested on the surface of the water. Fortunately the waves weren't running too high and the water supported the gondola. But the water penetrated the wood and fabric structure of the gondola and the four men sat there all night in water up to their knees. Next morning the sun expanded the gas in the balloon, which picked the gondola out of the water and the blimp made its way back to land and safety.

It's interesting to hear Hagemeyer contrast the early days and the old equipment with that used today: "We had an old English pusher biplane—the FE-2B—and a Curtiss Jenny for photographic planes when we first started making movies for the Army. The pusher had a cruising speed of 45 m.p.h. Now we have a Martin B-10B, but we need a newer and faster ship. The Martin will get up to about 175 m.p.h., which is too slow for most modern Air Corps' types."

Captain Fite explained further: "When we have to keep up with faster planes we borrow a Douglas B-23 or a Boeing B-17. Now we have been promised exclusive use of a new ship."

Orthochromatic film was the only kind available when the motion picture unit first started. Now the Air Corps uses a wide variety of films and filters; present-day films are about 10 times as fast as those used in the early days. Cameras, too are vastly improved. An f4.5 lens used to be the ultimate; now Wright

Disc recordings of technical lectures are made to accompany film-slide presentations sent out by Air Corps movie unit for instruction purposes. Below is record machine.

Animator at Wright Field photographs cartoon drawings on movie film for automatic landing picture.

L. C. Hegemeyer, civilian chief of Air Corps movie unit, poses with a sound effects outfit. Most of above equipment is part of toy sound effects "studio."

Field has cameras that use f1.7 lenses. In the old days 128 pictures a second was the fastest a movie could be shot. Today some of the high speed test cameras referred to above can shoot 2,200 pictures a second.

The old time cameraman used to wish for three hands—and really needed them to operate the old hand-cranked cameras, used overseas in the World War and later at McCook Field. Nowadays an electric motor does the cranking. The tripod head is equipped with a train of gears controlled by a gyroscope or rotating flywheel. The flywheel is set in motion by a tug at a handle and keeps the camera moving slowly and smoothly in any desired direction so the cameraman does not jerk his camera too rapidly from one perspective to another.

Most of those historical scenes in "Wings of the Army" were made by Hagemeyer. Two years after his narrow escape in the blimp, he was back again doing more overwater photography to record the bombing by Army planes of the outmoded American battleships *New Jersey* and *Virginia*, off Cape Hatteras, N. C. He also filmed the famous Alaskan flight led by "Hap" Arnold, now Major-General H. H. Arnold.

Whenever the newsreel companies want aerial pictures of Air Corps planes, the Army has its own photographers make and distribute them, so that all companies will share alike. Nearly always, "Hagey" has been the man behind the camera on these assignments, although recently he has turned some of this work over to other photographers who have been added with the enlargement of the unit.

To fill the position as chief of the laboratory is a triple job. Captain Fite must be able to fly an airplane expertly, have a smooth, pleasant authoritative voice to make the comments on films and for film slide records—and serve as scenario writer for all films the unit produces. Captain Fite qualifies in all three respects and, in addition to his movie lab work, holds down the post of technical data section chief, having supervision of public relations work and assembling data for reference use at the field.

He had experience with radio work before going to Wright Field At Maxwell Field, Alabama, he wrote and directed a series of Air Corps broadcasts presented over a commercial station. Previously he had written and presented a similar series while stationed at Randolph Field.

Three other experts in the movie lab—Bob Fitzgerald, chief animator; V. J. Svancara, sound technician; and Chester Tobias, chief of the film processing lab—all have taken special training in Hollywood motion picture studios. About two years ago the Wright Field movie unit was expanded, began making films of general interest as well as the test records, and pictures of notable events. Now it works on a production schedule similar to that followed in Hollywood.

Recommendations for pictures come first to Captain Fite from the Chief of the Air Corps' office in Washington. If the picture is to be historical, most of the film already has been shot and stored away in the big Wright Field fireproof film library. As in the case of "Wings of the Army," the production is largely a problem of editing and preparing the accompanying sound track.

Regardless of the nature of a proposed film, there is much research involved.

(*Continued on page* 86)

In the tiny sound-proofed theater at Wright Field, the entire staff of the Air Corps movie unit watches the first screening of completed parts of automatic landing film.

FLIGHT INSTRUCTION UNDER CONTROL

Training of civil pilots in the U.S. has been standardized by the CAA. Instruction now is identical, whether it's in Ohio or Arizona.

by GEORGE R. REISS

THE other day a friend of mine took a flight test for a private pilot's certificate at a certain Ohio airport. In our town, the fellow is known as an old timer in aviation. He has been flying as long as I have known him—some 12 or 14 years—and his log book shows hundreds of hours. Most of them were on Jennies and Standards and some on newer equipment. But his showing in the test was obviously poor.

"No," the Civil Aeronautics Board inspector informed him regretfully, "you won't do."

Paging through the man's log books, the inspector observed:

"You've got an awful lot of time—and mighty little check time right from the start. The trouble with you is that you've tried to learn the hard way—by teaching yourself. Go out and hire a good instructor for a while and then come back."

Dismissing him, the inspector turned to writing out a private pilot's certificate for another applicant—a youngster who had taken up flying only last spring and had only the bare minimum of 35 hours.

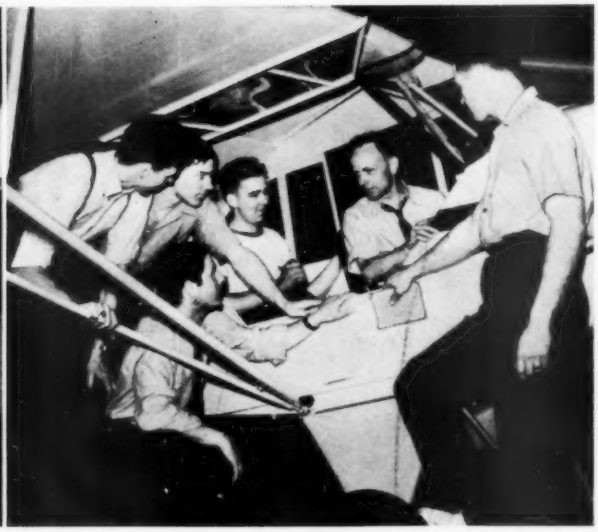
"Nice job," the inspector complimented the youth. "If only they all flew as well . . ."

That's just a little human drama you encounter occasionally at an airport where an inspector is giving flight tests. It doesn't indicate what seems so obvious at first—that the first fellow with his 12 or 14 years and hundreds of hours is hopeless pilot material and that the youngster, with his bare minimum of experience, is brilliant pilot material. Not a bit of it! It merely accents the difference in their types of training. It merely proves that *how many* flying hours you have logged isn't as important as how much good you've gotten out of your flying hours. It indicates further that the first man was trained by the old-fashioned, haphazard, hit-or-miss method of instruction that was so common at so many "cow-pasture" airports; and that the second man was trained by a rigid controlled instruction system—with plenty of dual instruction by a competent instructor, such as the course used in the CAA's Civilian Pilot Training Program.

Whatever else the faults and shortcom-

Anthony Canale, an Ohio CPTP student, is a typical "standardized" CAA civil pilot.

These CPTP college students also are taught ground work according to standardized formula. CAA plan has helped instructors.



D. M. Van Tassell, Youngstown, O., flight instructor, teaches CPTP group. Standardized training has dropped accident rate sharply.

ings of the Civilian Pilot Training Program, it is doing a valuable job in driving home the message of the real worth of controlled flight instruction and in putting the spotlight on the serious faults and defects of the haphazard system. Its outstanding virtue is the safety it has introduced to flying instruction, thus wiping out the chief argument against learning to fly.

For example . . .

CAA statisticians in Washington just have determined it is 30 times safer to learn to fly in the Civilian Pilot Training Program than it is out of it. Records show that, in 1939, instructional flying—both dual and solo—totaled 702,957 hours with 56,236,560 miles flown. There were 52 fatal accidents; 67 persons, instructors and students, died in this type of flying. Thus, 13,518 hours or 1,081,472 miles—equal to about 43 times around the earth at its greatest circumference—was flown for each fatal accident. That in 10,492 hours or 839,351 miles for each death.

In the Civilian Pilot Training Program only one student was killed—when the wings tore off his training plane in a too-violent recovery from a tailspin near Pittsburg, Kan.—in more than 400,000 hours of flying. That's about 30 times better than the 1939 showing. Thus the program is helping make safer and more competent pilots and to make flying the safest of sports or recreations—including bridge, ping pong or golf—and thus bring a tremendous influx of new private flyers, building up a huge pool of pilot material for any national emergency.

Oswald Ryan, a member of the CAA, recently declared the program will eliminate the necessity of ever repeating the situation which existed during the first World War when it became necessary to train military pilots with terrific haste and cost in human life. He pointed out the fact that more student pilots were killed in training in American aviation camps than were killed later in air battles over France. The CAA hopes to have trained 45,000 new pilots by July 1, 1941.

One of the major—and least publicized—objectives of the Civilian Pilot Training Program is to standardize flying instruction methods; a major achievement has been in raising the standard of instructors. In the old days almost any pilot, no matter how poorly qualified, could become an instructor. The only requirement was a commercial certificate and many young commercial pilots used instructing as a quick and convenient method of accumulating much flying time to qualify for some other flying job.

But the CAA program of rerating instructors has eliminated many of the poorly qualified instructors. You can bet that the fellow who comes through the rigid two-day oral and written examinations and flight tests as a rerated instructor really knows how to instruct. Nearly 1,000 civilian instructors are in the midst of "refresher" courses—courses which brush up their flying and also give them the necessary tips on how to teach others to fly—to augment the teaching staffs throughout the country.

What does this controlled course with rerated instructors really mean? Just this. One CAA field inspector, virtually swamped in flight testing both CPTP and private students, estimated that CPTP students aver-

Dr. Castle W. Foard (right), director of CPTP program at Youngstown College, also conducts classes in aerial navigation according to instruction plans of the CAA.

This CPTP student, having completed his dual instruction, is about to be flight tested by CAA inspector. Only one out of every 10 CPTP students fails this test.

age 38 to 40 hours in the air—usually 17 to 18 of them dual hours—when they come up for tests. They all are taught on the controlled course system by rerated instructors. He estimated that private students average 75 to 80 hours, few of them with more than 10 to 12 dual hours. Very few of these have been taught on the controlled course system and even fewer by rerated instructors.

Yet only about one CPTP student in every 10 flunks on his first flight test for a private certificate, while three or four out of every 10 non-CPTP students—remember, they average about twice as many hours, too—flunk in their first flight tests, this inspector estimated.

"That doesn't mean necessarily that the Government students are brighter and have the makings of better pilots," he said. "It means merely that they've had the advantage of better instruction."

"I'm convinced," the inspector commented, "that 24 out of every 25 applicants for private certificates who fall down in the flight tests do so not because they are incapable of learning to fly safely and well—but because they've never had the proper instruction. He cited as an example the case of a man who came before him recently. The fellow owned a light airplane and had piled up about 300 hours, most of them in "going places." He came for a flight test for a private pilot's certificate. His showing was a miserable failure. His entry into spins was bad and his recoveries worse. He floundered around in a spiral, overshot 400 feet on one spot landing, undershot on the next and skidded dangerously on every turn.

"How long," inquired the inspector when the lad came down, "since you've had any dual instruction?"

"Why, er . . ." sputtered the lad, evading the question, "I've got 300 hours."

"Have you had any dual instruction since you've soloed?" persisted the inspector.

"No," admitted the fellow.

"That's exactly your trouble," replied the inspector. "Now get yourself some dual time. It's going to be a hard job—for your instructor. But get a good instructor and try it."

The man came back three months later with five or six hours of dual instruction and a dozen hours of solo recorded in his log book—and turned out one of the most perfect flying jobs the inspector ever had witnessed from a private certificate applicant. Naturally he got the ticket from the enthused inspector.

Another good feature of the Civilian Pilot Training Program has been the policy of the Private Flying Development Division of the CAA of encouraging operators to go out after outside instruction business; in trading experience and in giving the operators valuable tips on maintenance, safety and methods of increasing public confidence and attracting outside business. One bulletin to the flight operators pointedly states that the purpose of the program is not to be a subsidy to the operator, but to provide education in aviation and that the consideration of operators for future participation will be influenced by the outside business they attract.

The bulletins advise the operators in the program to establish field lines and to line up their idle planes, with a uniform method of leaving the propellers, as a means of increasing public confidence. They urge caution in cold weather operations to prevent forced landings from frozen carburetors or other troubles. They advise operators to check out pilots before renting equipment to them and to mark propellers so that persons will not walk into them.

In short, they keep the operators well posted on a lot of things they need to know—something that hasn't been so common in aviation before.

They also advise the operators to bear down heavily on CPTP students to insure compliance with the regulations and to maintain discipline. A breach in discipline is one of the surest ways to be dropped from the program. For example one student, enrolled in the program, was sent out on his cross-country flight. When he returned to the airport his observing and conscientious instructor noticed considerable oil on the cowling.

"How'd that get there?" the instructor inquired.

"I can't imagine," replied the student, pretending he was mystified by it.

The instructor investigated, determined that the student had attempted two loops, believing that he was not observed and no one would know the difference. The immediate result was that the student was dropped from the program, for the controlled course does not provide for acrobatic training and the aircraft used is not designed for that purpose.

There's a purpose in maintaining this rigid discipline, also in the regulation that no student enrolled in the CPTP take any dual or solo fiight training while taking the course, except as prescribed in the course and under the instructor to whom he is assigned. The purpose is to prevent accidents such as the one which happened to one of the trainees. The student involved was visiting his home 60 miles away from the university. At his home town airport he borrowed an airplane and, accompanied by a friend as a passenger, took off for a flight. It ended in a crash which killed the student, seriously injured his friend and destroyed the airplane. An investigation showed the student had had only six hours of dual instruction in the program, but had had some previous flight instruction and had a few solo hours logged.

Operators outside the CPTP also found the controlled course quite valuable in improving their business.

"One of the troubles of uncontrolled flying instruction," one instructor complained to me recently, "is that it is too rough on the instructor. You sort of like to be able to keep an eye on the boy for whom you're responsible. Too often, after I've soloed a man, I never see him again until he shows up and informs me 'I'm going up for a flight test. How about an hour of check time?' If, after that hour of dual, I tell him he's not yet ready for a flight test and needs a lot of dual instruction, well, he gripes to his friends that I'm a hell of an instructor, I didn't teach him right in the first place and now I'm trying to gouge him for a little more money.

"No, a good controlled course of instruction works to my advantage in the long run. If I can teach a man to fly in a short time, he gets more real fun out of it, is more likely to remain interested in flying and he brings along a lot of friends who likely will be interested, too."

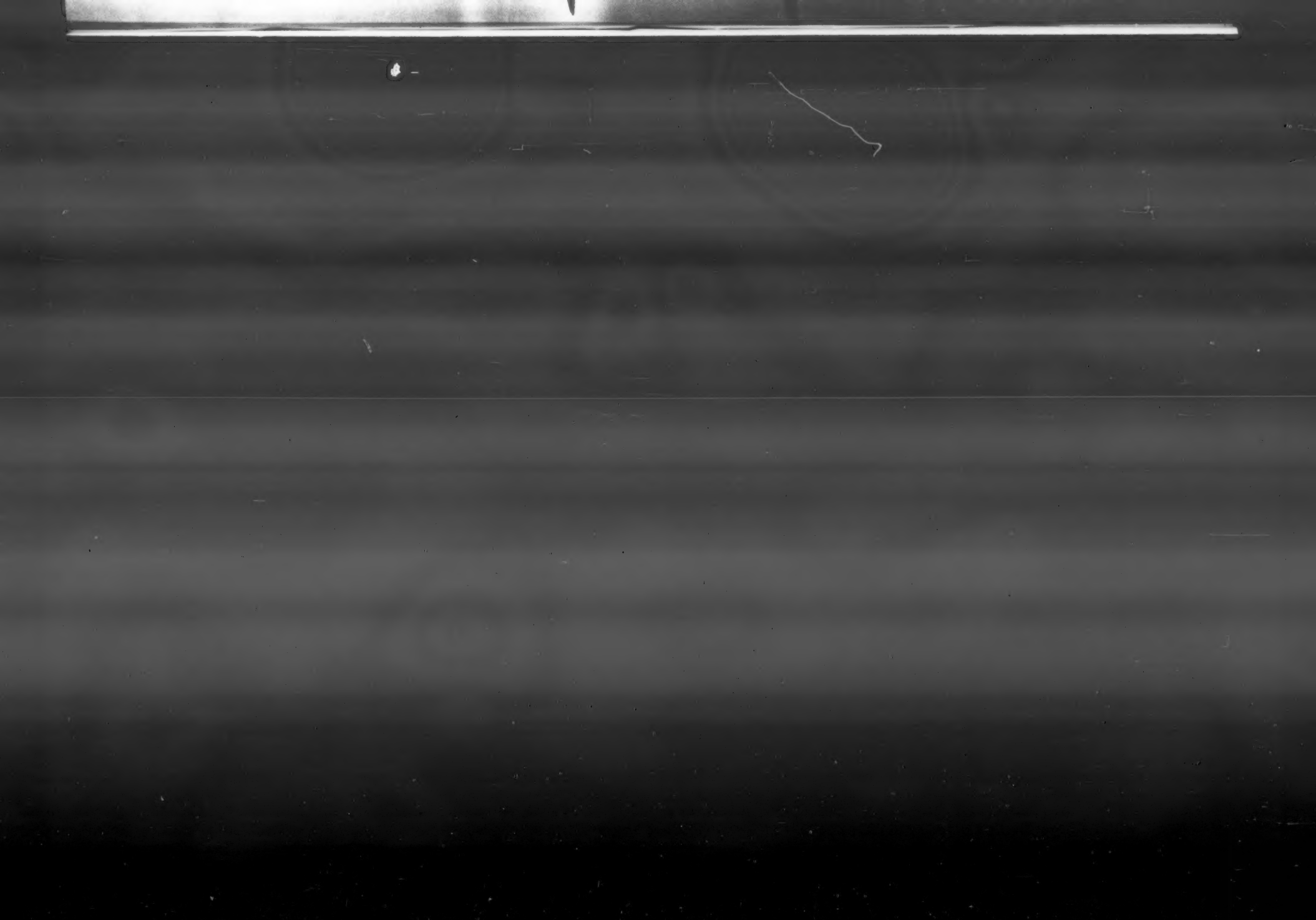
How about a good controlled course which the pasture-lot operators might follow to advantage? Well, here's the procedure the Civil Aeronautics Board would recommend:

Stage A

Preliminary ground instruction:

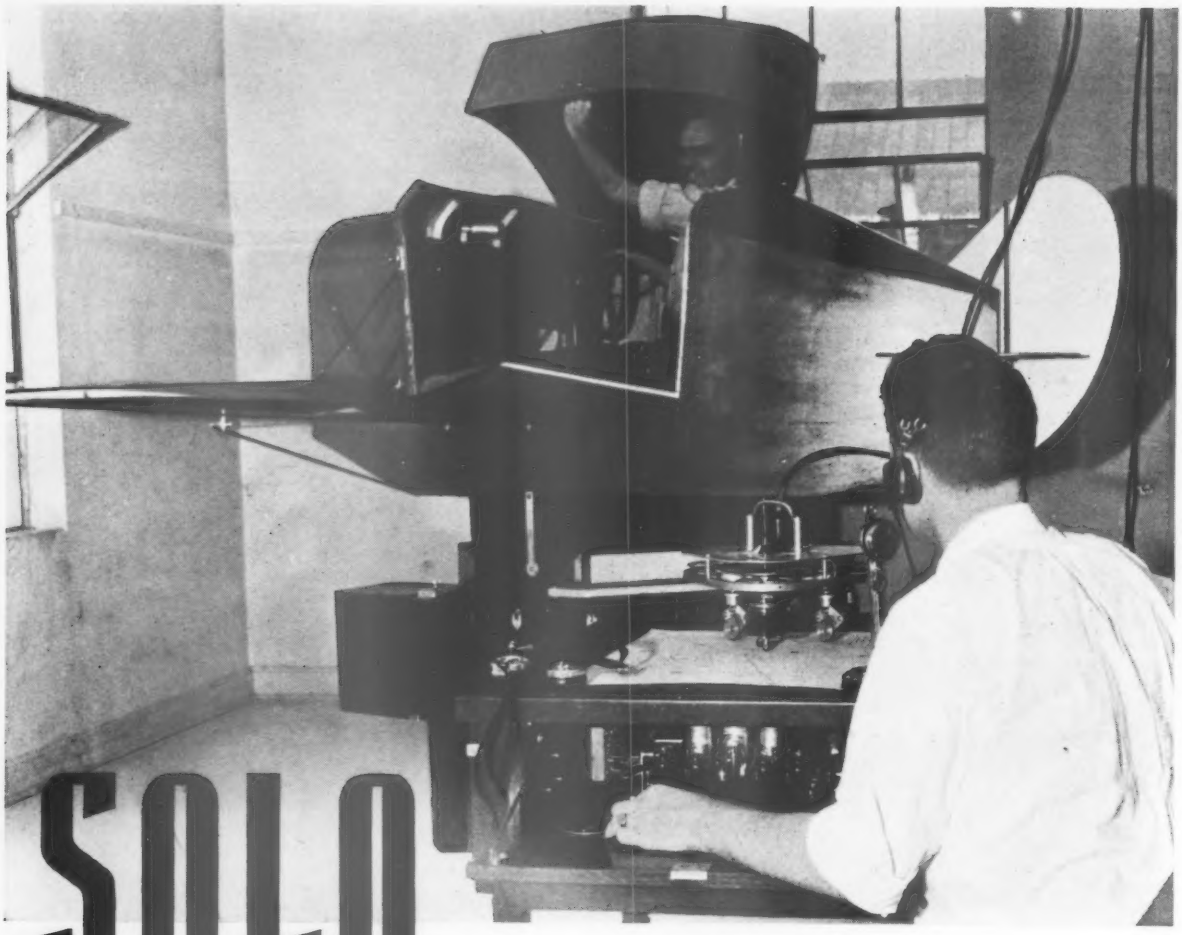
a. Familiarization with airplane.
b. Simple explanation of controls.
c. Simple explanation of instruments.
d. Explanation of throttle.
e. Explanation of brakes.
f. Explanation of fuel system.
g. Use of safety belts.

(*Continued on page* 83)



SEAGOING SENTINELS

These Vought-Sikorsky OS2U-1 catapult scouts, based on the battleship "Mississippi," are the newest eyes of the U. S. Navy.



SOLO *from the Start*

by JOHN R. HOYT

Teaching a fellow to fly in a Link Trainer is a new and highly promising wrinkle in flight training. Many eyebrows already are raised at results.

THE room is quiet and mysterious. If it were dark you might think you were out of doors because there seems to be a horizon of hills and terrain on all sides. In the center of it all is an airplane that makes only a slight whirring sound. Suddenly the wings dip, the nose swings around and points 90° to the previous course. You've guessed correctly—it is a Link Trainer in action.

But the action in this instance is not instrument work. The hood lies open and seated in the cockpit is a would-be pilot about to take his first flying lesson. His eyes are glued in student fashion upon the horizon as he attempts to turn the nose of the Link in a co-ordinated turn. Earphones on his head are the only contact he has with the "ground"—he is literally soloing during his first hour of instruction!

The horizon that he is viewing with such rapt fascination is a rolling hill, a shaded valley, a stream and a clump of trees that seem to stretch before the nose of the Link. It is proportional to his altitude of 3,000 feet and looks exactly as you would see it if you were flying at his level. It is colored, shaded and mottled in the shades of the current season and when winter comes easily can be removed and changed to accommodate the snow-whitened landscape. The answer is of course a tall canvas screen upon which a group of industrious art students have painted a panorama. The screen is about 10 feet high and perhaps 75 feet in circumference making the room 24 feet across which is just about right to "fly" in. Here and there the cumuli of fair weather floats serenely across the unchanging landscape; a farmhouse beside the woods with black smoke blowing from the chimney to indicate wind direction . . . although what such a fire is being used for in mid-summer we did not inquire. A windfall also is headed directly into the wind—all pointers that the student is taught to become aware of.

At present the student is headed on one of the roads that run north-south and east-west on the Link panorama. He is soloing

AMERICAN AIRLINES

An ingenious gadget on the Link is a device that simulates unfavorable flight conditions.

TWA

The instructor, sitting at his desk, sees instantly what his student is doing. "Ouija board" on desk top automatically charts flight path.

safely yet he has had only 15 minutes of flight training. Slowly the nose swings around as he does a precision turn, stops uncertainly on another road, dips, wobbles and comes to level flight. Easy? Well, perhaps.

Suppose that you are the student in the school and have been selected for flight training. You meet the instructor who appraises you critically: Your eyes and features which often betray temperament or your actions which indicate stability. He enrolls you and enters your name on a chart which will eventually become a permanent record of how your head behaves from an objective standpoint and how well you co-ordinate mind and body.

You need only a short description of the controls before your first solo flight. The explanation is simple: All you have to do is exert pressure upon the controls in the direction you wish to travel. That is, should you desire to raise the nose your pressure is a pulling back on the stick. If you wish the right wing to go down, you merely press the wing down. And as for the rudder remember this: Rudder is almost never used except in conjunction with the wings (ailerons). That is, if you exert pressure on the left aileron, you must apply pressure to the left rudder at the same time. That is called coordination. Such instruction is contrary to instrument flying as taught in the Link, but remember this is not an instrument course. Finally, it is explained that turns to the right or left are made by pressure on the ailerons which depress or bank the wings in the desired direction of flight. You get into the Link and put the headphones on. The motor is started and the controls become responsive. The instructor wants to know if you can hear him comfortably, and you nod your head.

"All right," he says, "let's fly down that road in front of you. Fly straight and level at 3,000 feet where it is nice and safe. The horizon in front of you is exactly as you will see it the first time you go up and the nose, wings and controls are very similar, too. Now go ahead and fly."

You do—trying to keep the wings level and the nose on the road ahead of you. Your greatest trouble will be with the rudder because you will try to steer the airplane on the road by pressing right or left rudder. *This habit must not be allowed to develop* as it is pernicious and will result in skidding turns throughout your flying career. Remember the rudder is used with the wings; you almost never use rudder except when you bank. The exceptions are rare and will be shown later on in such maneuvers as the forward slip or the full-power climb, but then such maneuvers are not used in primary training prior to solo.

"That's fine," says your instructor. "Now turn to the right 90° and come out on that road over by the farmhouse. Don't forget: When you want to turn, press the right wing down and at the same time press right rudder."

You try it. The nose of the Link swings jerkily around. Of course, the controls are not co-ordinated which means that you have not pressed proportionately on the ailerons and the rudder. But when you come to the heading and exert opposite pressures which stop the turn, you have completed the first maneuver of your flying career! So it will go throughout the course. As the flying proceeds, the instructor analyzes you keenly and jots down your reaction to instruction, to criticism, to correction. The chart he makes of you will indicate clearly what you are, but primarily it will show whether or not you are a good flying risk, whether you can be depended upon to react normally in most situations and will solo after an average amount of instruction.

For example, suppose that the instructor tells you to do a 360° turn, but you forget and do a turn and a half. On his chart he would have three columns, such as:

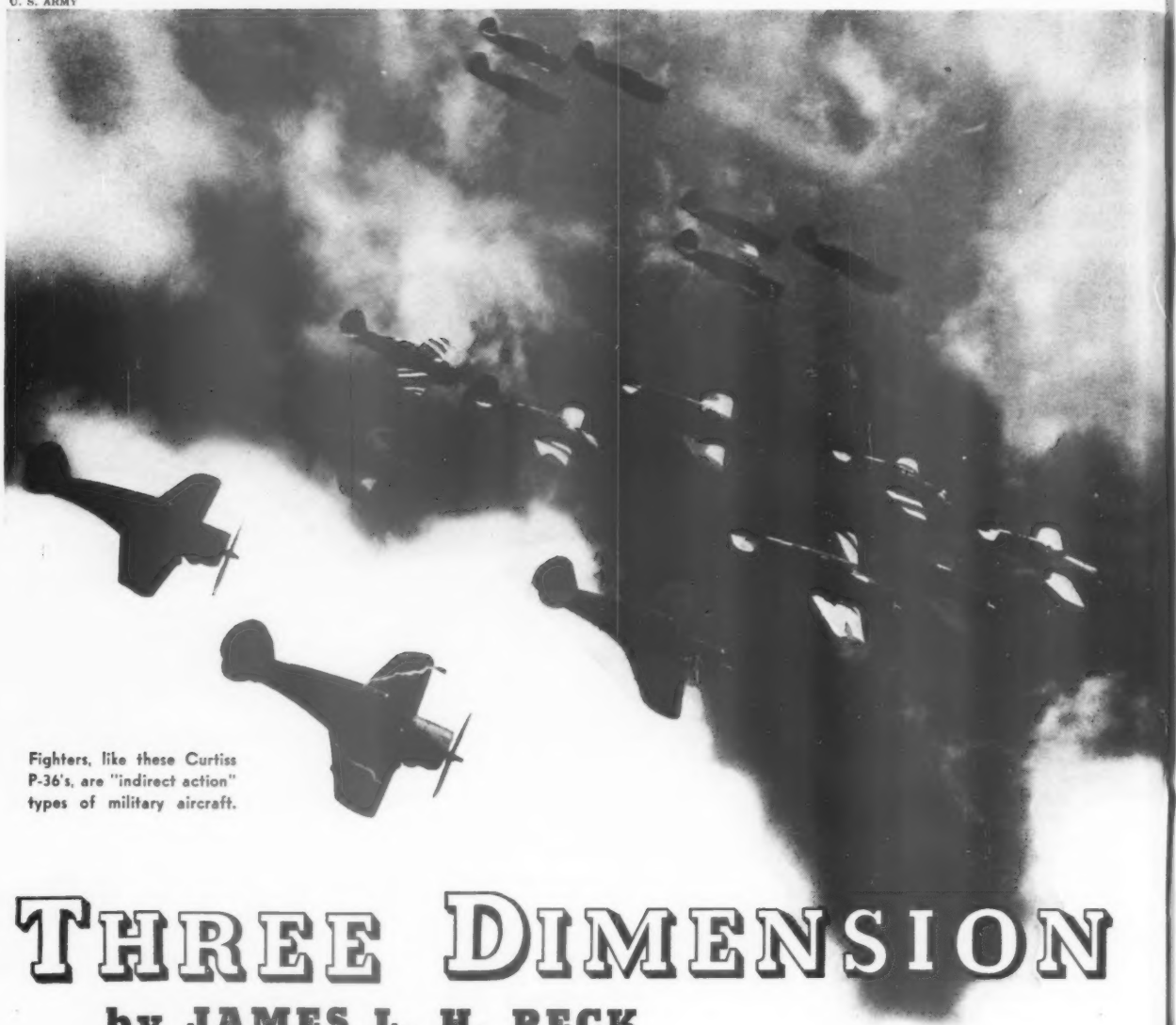
Mental
Alert
Told twice
Too many questions
Inept
Fails to retain
Uninformed
Comprehends quickly

Psychological
Emotional
Angers easily
Fearful
Over-anxious
Too anxious to please
Over-confident
Easily confused
Well-balanced

(*Continued on page* 74)

Mistakes of student are corrected immediately by instructor through microphone.

U. S. ARMY



Fighters, like these Curtiss P-36's, are "indirect action" types of military aircraft.

THREE DIMENSION

by JAMES L. H. PECK

A NEW and unpredictable year is at hand and, uncertain as it may prove to be elsewhere, it certainly promises to be an air year both at home and abroad. Although airpower has proved itself in a most conclusive fashion during hectic 1940, no generally accepted doctrine—such as has been propounded for land and sea forces—has been prescribed for the air arm. This all seems rather strange in view of the fact that all air forces are employed in accordance with more or less standard strategy and tactics this troubled world over.

Such vague and varied terms as "command of the air," "air control," "air mastery" and "air superiority" with which correspondents' dispatches and official communiques are filled, do not make for clear conception of the aerial goings on. Nor do the indefinite references to "offense" and "defense" in the air.

The basic principles of this new war remain the same—even as the considerations of objective, offensive, mass, surprise, movement, etc., were observed in one way or another by ancient warriors—but fearful modern weapons have greatly influenced the *application* of these fundamentals. This, then, is the big picture into which airpower must fit. It influences the application of the basic war principles by carrying conflict into the third dimension; and three-dimensional warfare is not particularly a series of offensives and counter-offensives against "fronts" but is, rather, a "war of areas." The so-called fronts are of little avail, indeed, once the enemy's back areas and communications have been ravaged. Sufficiently undermined, they become top-heavy and collapse of their own dead weight, however valiantly defended. Because airpower possesses far greater range, power of evasion, penetration, and strategic concentration—the military essentials of offensive operations—than any ground or sea force, it is the most suitable agency with which to conduct this war of areas.

Land and sea power must have the support of aviation to win a decision in today's war. Deprived of it, they cannot be furnished the necessary security and freedom of action. This is not to say, however, that the airplane can win wars by itself, although this may conceivably come to pass some day. Today's airpower *contributes* to victory only insofar as it affects the situation on the surface. Complete destruction of the *Luftwaffe* by the R.A.F., for example, would not in itself defeat Germany, but would make it possible for the British Expeditionary Force and the Royal Navy to do so by affording them a security and freedom of action these surface forces will not enjoy so long as the German Air Force remains awing.

In a strategical sense, "complete destruction" is much too inclusive a term

British carrier-based warplanes, like the "Skuas" at right and bottom of page, play vital role in backing up British Navy.

ACME

as is the widely used phrase "command of the air." All that is required for the security of land and naval units is what is more properly called "air superiority." This happy state exists when one's air arm can operate with only occasional enemy interference; while, contrariwise, enemy aircraft must generally fight—and lose men and machines—in order to complete a mission. Because such superiority is relative—and may shift with the enemy's accretion of a new-type plane. armament, or tactics—there is no such thing as absolute command of the air. Imponderables such as morale, changes in national policy and attitude and increasing—or decreasing—vulnerability of the enemy's factories, airdromes and communications further affect the aerial balance. There are most interesting examples of this shift of balance.

After the German air force had enjoyed unchallenged superiority in Poland, Norway and the Low Countries—an advantage concurring from quantity as well as quality of aircraft, airmen and ground organization—the tables turned, temporarily, in favor of the R.A.F. during the Dunkirk evacuation. In a very limited theater of operations, and for just sufficient time to support the withdrawal of Allied troops, the R.A.F. gained local air superiority, largely through the accrument of a number of Boulton-Paul *Defiant* "destroyers." This afforded the British an edge in quality which more than compensated for the Nazi numerical superiority—but only within the Dover Strait area. German quantity, of course, immediately shifted the balance to a more even keel; at this writing it's nip and tuck. The change of British policy, shortly after the Battle of France, is more than indirectly responsible for the near parity of the air forces. Prior to the more aggressive stand, the *Luftwaffe* met only sporadic resistance.

The third factor—vulnerability of factories, airdromes, and communications—is one resulting chiefly from the geographical location of the belligerents. In the British Isles, Hitler has the most vulnerable target in Europe to operate against. The great Midlands industrial area which lies, roughly, within a quadrangle drawn between Bristol, Liverpool, Leeds and Norwich, has little depth in which to provide warning of and defense against attack launched from French and Lowlands airdromes. Conversely, Germany's highly industrialized Ruhr Valley lies about 150 miles from the North Sea,

WAR

The airplane has changed warfare to an extent that has startled even liberal military minds. Initial Nazi successes were due almost entirely to the fact that German generals realized this.

CHARLES E. BROWN

BRITISH COMBINE

Backbone of airpower is production. These are Bristol "Blenheims" under construction at British "shadow" factory.

thus affording depth of defenses—prerequisite of successful anti-aircraft measures — Britain's location, unfortunately, does not make possible. Before and since the launching of the air plague, the R.A.F. has traded blow for blow, raid for raid. In order to accomplish this, however, they must fly much farther, face deeper and more complete defenses—ground and aerial—spend the greater part of their flying time over hostile territory. Berlin and northern Italy, recipients of many a British bomb these days, are still farther away from the Isles.

How, then, is air superiority gained when so many ponderables and imponderables govern the aerial balance? It is dependent upon the employment and the interaction of the air force branches. Long-range bombers and reconnaissance bombers carry on deep in the hostile rear and flanks. Patrol bombers keep watch over the sealines. Medium bombers are assigned less advanced objectives. Attack bombers and dive bombers are given the job of grounding the enemy air force by the destruction of airdromes; they operate against troops, tanks, guns, fortifications and other obstacles immediately confronting friendly ground units. Transport planes haul the 'chute detachments and aerial infantry into the enemy rear: these daring young men become roving bands of saboteurs who do all possible damage to communications and make contact with fifth columnists. Pursuits and interceptors keep the air clear of hostile planes of all types; thus, preponderant strength in pursuit aviation is particularly necessary for air superiority. Strangely enough, fighters, pursuits and interceptors are called "indirect action" types, even though they constitute the fighting force of airpower. The reason for this is that these combat craft influence the military operations only insofar as they *protect* friendly "direct action" planes—bombers—or interfere with planes of the enemy force. Bombardment is the mission of airpower, the fist of the air arm, and is "direct action" because it directly affects the situation on the ground, where the decision of battle rests.

Reconnaissance aviation, meanwhile, is employed to maintain security and guard against strategic surprise by the acquisition of enemy information by observation and photography. Reconnaissance is charged with four types of missions: *laison*, to keep the divisional command informed of advance ground units' location, progress, and supply requirements; *contact*, to keep these advanced units informed as to the strength and position of enemy advance units and to "warn" the friendly units of danger; *artillery*, discovery of targets in enemy territory and range-correction during the subsequent shelling of these targets; *miscellaneous* missions, to carry out impromptu command reconnaissance (verification of certain information received from Intelligence or fifth columnists), laying of smoke screens, dropping of flares for night guidance or attacks by air or ground units, and contact with friendly bombardment, attack, or pursuit.

Actual "eyes" of any fleet are catapult planes like American SOC-1 scout below.

ACME

Naval aviation, contrary to the popular impression, does not operate independently, but as a part of the fleet. There are, for example, the battle force, cruiser force, scouting force and the air force—and teamwork is the watchword. Sea communications are maintained by the "train" (supply ships, tankers, tenders and perhaps a floating drydock), in the same manner as logistical establishments provide the ground forces with material and munitions.

We are too prone, these days, to think of airpower in terms of aircraft alone, perhaps because cause is subordinated to effect in the war communiques. Planes do not constitute an air force. Pilots must be trained to fly these hot-to-handle fighters and bombers. Combat crews —gunners, bombardiers, navigators and radiomen—must be trained to assist the pilots in flight and fight. Airdromes must be constructed and outfitted to carry on maintenance of planes, personnel and equipment. Mechanics, armorers, meteorologists, radio operators and repairmen, electricians and other technicians must be immediately available to effect this maintenance. Administration demands its quota of staff officers, engineering officers and clerks. Medical and supply departments must administer to all this personnel. All this is required to make an air force.

By the same token, an air force does

(*Continued on page 63*)

I LEARNED ABOUT FLYING FROM THAT!

—NO. 20

BY

ALMA HEFLIN

"We coasted onto the field at Gakona, a trading post on the Copper River, as engine stopped."

Alma Heflin

This girl flyer, on leave from her job at the Piper factory, discovers that nothing is so precious over rough country as altitude.

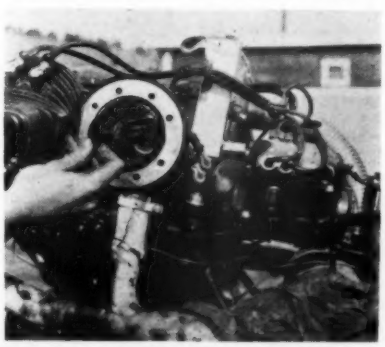
IT took me three years and 500 hours of flying to find that Bill, though a backseat driver and not far beyond the student stage, was right.

Bill was my passenger on a trip across the Okeechobee Swamp of Georgia. That's a devil's brew, if there ever was one. It stretches for miles with hardly a spot of solid earth bigger than a pancake and bleak in tangled cypress and Spanish moss. Awful tales are whispered of desperate criminals and mad degenerates who hide on the soggy banks of its bayous. No place, decidedly, to play. There we were, droning along at about 1,000 feet while Bill griped.

Bill wanted to grab as much as possible of 10,000 feet so "if the motor conks we can coast to a landing." I wanted to cover as much distance horizontally per gallon of gasoline as possible. We had little gas left, our head wind had stiffened badly and when we turned toward an auxiliary field we found it fogged in. It was Jacksonville, or else. I couldn't see wasting gas on climbing and, as I told Bill icily, if the motor conked, there was no place to glide to anyhow.

That's where I was wrong. Motors don't always conk completely, and you can do a heck of a lot of travelling on two cylinders if you've room to glide. The learning of that lesson this summer was the reason I telepathed sincere and abject apologies clear across America to Bill for fifty-five minutes while the tundra and hills of Alaska unreeled below.

Margie McQuin and I had flown from New York to Seattle, shipped to Juneau and then flown on to Fairbanks, Alaska, over country that could have been conceived only by God and the Devil working in amicable partnership. It is undoubtedly the loveliest country in the world, but for bleak distances and dangers ranging from swamps to fanged mountains, even the Okeechobee looks tame. Neither Margie nor I fully appreciated the dangers of the Juneau-Fairbanks flight in a single-engined lightplane with landing fields three and four hours apart.



This is the broken valve that forced the author down in Alaska's rough interior.

We had purred along at a happy 1,000 feet, even dropping sometimes to a bare 50 to check direction of a river current to confirm our navigation. Arrived safely at Fairbanks and completing some side-trips, our summer plans were practically fulfilled.

It was then that I had my lesson on altitude. Someone told me of a herd of buffalo at the ferry on the Tanana River. When a friend found himself stranded that same afternoon and no charter plane available in time to make his boat-sailing at 8 p.m. in Valdez, we decided I could get some good pictures and deliver him to the dock at the same time.

We started from Fairbanks with a quartering tail wind and, though rain squalls were reported by trading posts ahead, we had a 3,000 foot ceiling even over Isabel Pass. Blue cumulus clouds massed over the mountains should be blowing away steadily. We turned our nose southward, found the buffalo missing at the ferry, then started climbing before reaching the mountains. Rain squalls were bad in the pass, masking the windshield with sudden deluges, the wing-strut thermometer barely over freezing. We had 6,000 feet and were on the lower fringes of rain clouds over the field at Rapids. Later, I checked the field there and found it merely a cleared spot that no one would especially seek

(*Continued on page* 82)

SKY-HIGH FREIGHT

Peruvian natives above are loading iron piping into the waiting Curtiss "Condor."

Below is Earl Smith and the "Condor" freighter he piloted across the Andes.

by KURT RAND

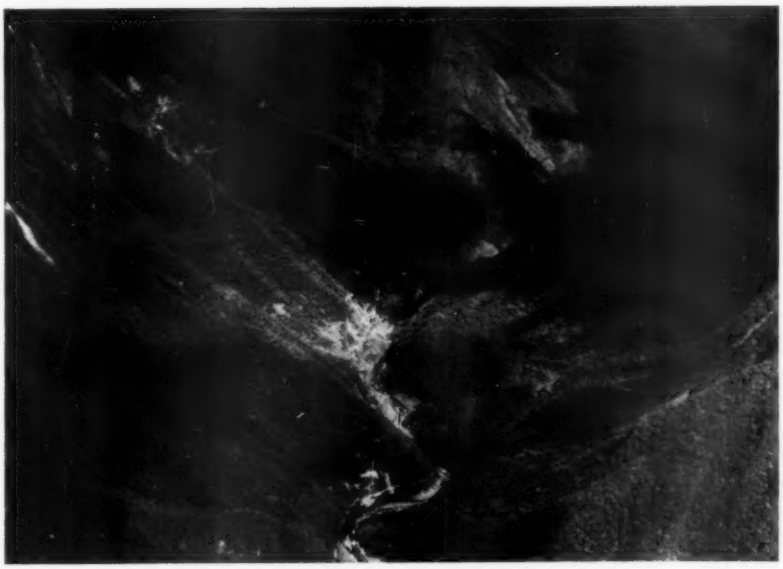
This is the kind of flying that would give the average pilot the shivers. In Peru, though, they take it for granted.

IF it's a story you want of the fellow who tackled a tough job that "couldn't be done" and then went ahead and did it, then we'll give you the story of Earl Smith and Condor Air Lines of Peru—or Condor Peruana de Aviacion S. A., if you prefer.

We've all heard the stories of how the boys flew over the almost impossible flying country, tackled the almost impossible weather conditions, carried the almost impossible heavy loads—but most of that is mere child's play compared with the job that Condor Air Lines did—and still is doing—every day in the high Andes of Peru.

For Condor Air Lines, true to its namesake, probably is the world's highest-flying airline. Its huge machines, built to carry two-ton loads, regularly stagger along with four-ton loads of freight over terrain so rough that a forced landing would be almost sure death, threading their way among storm-shrouded peaks extending to 16,000 feet, with turning back impossible because of excessive downdrafts—then landing on high-altitude postage stamp-sized fields so tight and small that any sane man would hesitate to land on them in a *Cub*.

Earl Smith is a rotund, partly bald, amiable man of 46, an air pioneer of the old school who got tired of the rather prosaic job of piloting a lumbering airliner loaded with inquisitive passengers over the same old route, day after day. He had sought—and got—adventure. Today, you'll find him in Washington at the Bureau of Standards aircraft engine fire test laboratory, with a whole raft of stories to tell of his exciting adventures in helping Hughie Wells to establish Condor Air Lines with a fleet of



The slopes of Brazil are covered with a wealth of inaccessible mahogany forests.

brand new Curtiss *Condors*—swell ships for the very difficult job.

Today, the job of flying those lumbering machines—loaded to the cabin roof with lumber, steel, cast iron pipe, groceries, livestock, dynamite, automobiles, tractors, gasoline, fuel oil, machinery and whatnot into interior Peru where there isn't a semblance of a road—has become more prosaic, more uneventful.

But it wasn't a picnic four years ago. Then the mountains back of Trujillo, Peru, were an impenetrable wilderness, accessible only by a tedious three- or four-week journey on muleback over treacherous trails. There were neither landing fields nor civilization back in that unfriendly wilderness.

That was back in 1936, when Smith was a pilot on Eastern Air Lines between New York City and Washington. Even then Smith already was an old timer, with 15 years of flying experience, having flown with Lindbergh on the old Robertson Air Lines; flying Fokker F-10's for Universal Air Lines between Chicago and Cleveland; Fairchild 71's for Clifford Ball between Cleveland and Washington; tri-motored Stinsons for Ludington Air Lines between New York and Washington and now Curtiss *Condors* for Eastern.

The job was getting a little tame when Hughie Wells called Smith one day and inquired:

"Want to go to Peru?"

"Sure," replied Smith, "when do we start?"

Wells quickly outlined his scheme. Some old gold mines in the Andes had been idle for centuries—since the days they were worked by Spanish slaves. Now they were unworkable because of the tremendous cost of transporting supplies. Every pound of food, steel, dynamite, machinery, fuel, lumber and other supplies had to be packed in on muleback, over the rough mountains where the mules became short-winded and played out.

But if supplies could be transported in at reasonable cost, the mines could be worked profitably. Others had successfully flown supplies by air into interior Alaska and northern Canada, in Central and South America—but this job eclipsed all others. For nowhere else were the mountains so high, the weather more unfavorable, the available field so tiny and rough and so far above sea-level where the air gets thin.

"And," added Wells, "this job is over some of the world's toughest flying country. Some folks say it can't be done. Still want to go?"

"Sure," replied Smith promptly. "We'll do it."

Smith promptly resigned his airline job. Then he and Wells chose the Curtiss *Condor* for the flying job. It's probably the only ship that could do this particular job. The *Condor*, you will recall, is huge twin-engined biplane which reminds you of the roominess of a barn. It can lift almost anything you can pile into it, it's stable as a church, as easy to maneuver on the ground as a flivver plane and, with its retractable landing gear, not too much slower than a Douglas. But there are few of them left today in the United States. Wells bought four brand new ships with all the latest gadgets.

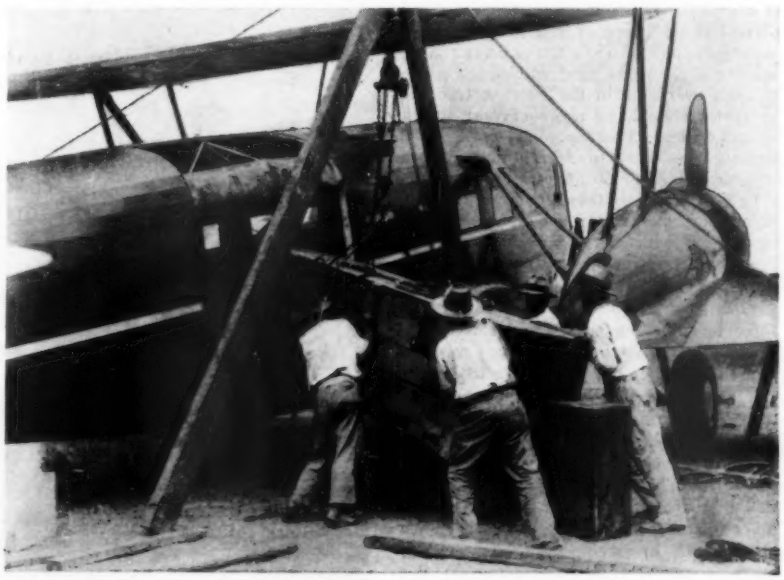
Then Smith set out from the Curtiss-Wright factory at St. Louis with the first of the fleet, flying to Lima, Peru, in 36 hours—part of it over a 1,000-mile stretch of open water. Then came Smith's big job—that of locating landing fields near the mines, and one coverting the *Condors* for handling freight. With a party of Indians to serve as guides and camp makers, Smith set out with a train of mules loaded with supplies for the interior to locate the first field. It was a hard, wearing journey that required a month. It was a discouraging search, a month of hardship, sleeping outdoors and eating Indian food—and finding no signs of a possible landing field.

Just as he was about to give up and confess failure, Smith located an "airport site" near Lake Piaz. And what an airport site! The best you could say for it was that it might become a possible place to land. Nestled in a box canyon formed by mountains rising 8,000 feet above it and pouring avalanches of turbulent downdrafts on it, it was just a tiny scrub-covered level place. It was thousands of feet above sea-level, up where the air becomes rare and loses much of its lift. At best, it would always be a "one-way" field, without even room for any chance over-shooting the field and making another try.

But it was an air field, 165 miles east of Trujillo, Peru.

Smith and his party, with their few crude tools, hacked off the scrub to form a tiny runway a few hundred feet long—just large enough to land. Then they returned to the coast. Smith assembled a crew of workmen, equipped them with axes, picks and shovels and wheelbarrows, then flew them

The "Condors" carry far heavier loads as freighters than ever were permitted in the United States. Below, a huge piece of mining machinery is loaded aboard ship.



This is the first automobile ever seen east of the Maronon River in Peru. It was flown across the mountains in the "Condor" in the background. Date: June, 1936.

back to the site he had discovered. Eventually they hacked out a runway 150 feet wide and 4,000 feet long.

Back at Trujillo, Smith took charge of altering the *Condors* so that the really big pieces of freight could be loaded easily into the cabin. He was particularly well equipped for that job, for he had operated a repair station as a sideline for 10 years at Washington airport. But this job represented some real problems. He had no welding gas, so he made his own. He sawed out a section of the fuselage tubing, rigged it with pins so that it could be removed easily when loading was underway, then could be replaced when that was done, making the fuselage as strong as ever.

Those *Condors* got some real loads. Licensed in the United States to handle a maximum of 4,000 pounds, they paid their way in Peru by carrying 7,000 to 8,000 pounds regularly, supplying three large mines within a few miles of the field.

Other pilots with Smith on that job were Scotty Burmud of St. Louis, Robert Supple of Los Angeles and Bill Alexander of New York. Within a short time the ships had ferried in 1,200 tons of freight to the mines —enough steel at $150 a ton to erect a large stamping plant, the first trucks and automobiles ever seen in the interior, tractors, groceries enough to equip several stores, dynamite and other supplies—cutting the tedious three-weeks muleback journey to a comfortable 45 or 50 minutes by air.

One special job they got was ferrying in a large quantity of wide-diameter steel pipe for a hydraulic line. Engineers had found two tiny mountain streams near one mine. Neither stream, pouring down the mountain side, furnished sufficient hydraulic force to solve the power problems of the mine. So the engineers resolved to combine them. They piped the water from each stream around the side of the mountain, poured it into a single sluiceway far above the mine and, together, the two streams furnished plenty of power. But it took a lot of hard, dangerous flying to move in that pipe from Trujillo to Lake Piaz, 165 miles inland from the Pacific Coast. They also carried in machinery shafts, a giant crushing machine and other materials. But Smith's most-hated loads were the tons of dynamite.

"No," laughs Smith, "that job wasn't exactly child's play nor a job for a fellow with a bad case of nerves. Many is the time I sweated hard, for it was plenty of work to take such a heavily-loaded ship through the clouds which sometimes shrouded the passes. That air really got thin up there.

"One 20-minute stretch each flight really was hell—a stretch so rough that if a motor had lost a few revs it might have been fatal. It took all your power to hold your altitude with such loads. The fact that we never had a fatality was a real tribute to our maintenance crew."

Once over the hump it was impossible to turn around, for the cold sea air, sweeping down over the peaks, formed vicious downdrafts which carried the heavily-loaded planes down swiftly to the levels of the landing field on the east side. Even lightly-loaded, the Trujillo-bound planes had difficulty in overcoming the downdrafts and climbing over the jump.

Instead of parachutes each pilot carried a pistol, for a parachute landing would be very hard and dangerous in that high altitude country—and even if a pilot got down safely, he still faced the dangers of starving or freezing to death. The pilot preferred to stick to his ship—and the pistol might came in handy to end suffering in case he were badly injured.

Fog shrouded Trujillo for four months each year. But, happily, there always was 300 or 400 feet of ceiling beneath the fog banks. A pair of high peaks extended through the fog to mark the spot where the pilots—the planes were equipped with radio but there was no station at Trujillo—must begin their glide to get through the fog safely.

Smith once had a dangerous experience while trying to fly a heavy load of lumber from the Trujillo airport. The lumber, in 15-foot lengths, had been carefully blocked and secured in the 22-foot cabin. But just as Smith lifted off the *Condor* the blocking gave way and the load slid to the rear of the cabin. Unaware of what had happened but finding the ship so tail heavy that it was virtually impossible to keep it from whipping into a stall, Smith threw his entire weight against the control wheel. He nursed the ship around the field, found it too tail heavy to glide in and finally flew it in to a heavy landing on the airport.

"I learned a lot about flying that day that I didn't know before," he comments.

Supple had an amusing experience with a load of lumber he was taking from Trujillo to Lake Piaz. As he approached the field at the lake he tried to lower the landing gear but found the electric equipment for lowering it had failed. The lumber covered the manually-operated equipment, so he faced the possibility of setting down the four-ton load in a belly landing.

Turning to the helper who rode with him, Supple ordered:

"Get back into the cabin and throw out the lumber."

"Oh, no," the helper shook his head.

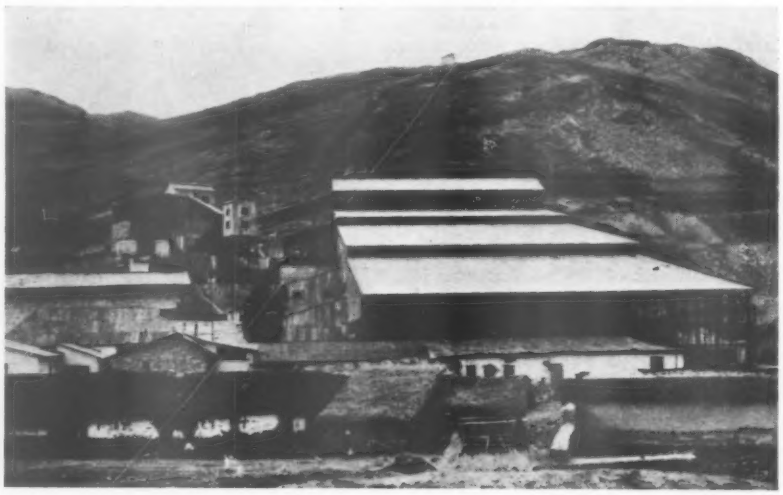
Supple gritted his teeth and spat.

"Either you throw that lumber over the side or you go over."

The helper threw out the valuable lum-

(*Continued on page* 88)

All the steel for this gold mine stamping mill high in the Andes was flown in by the "Condors." Airports never were more than clearings hacked out of the jungle.



Proficient Professor

by George E. Jones

You probably know Professor Kirsten for the novel pipe he invented. But he is equally famous in aeronautics for many more far-reaching developments.

AMERICA has resolved that it shall become the mightiest air power on the face of the globe. Raw materials, executive direction, unplumbed industrial capacity are at the disposal of this nation.

But go a little further. Can we match the inventive, single-minded ingenuity by which Nazi Germany forced an unwilling world to recognize the airplane's staggering importance in modern warfare? Some say no. They say our independent research laboratories cannot hope to obtain the results that Adolf Hitler attained through a German science regimented into a martial groove. Look, however, at these words:

"We have unlimited capacity. Our ability to invent, to create, can be as dominant in channels of defense as it is in peacetime pursuits."

These are not the words of a bumbling politician who seeks to create a false illusion of security. They come from one of our foremost aeronautical inventors—Frederick Kurt Kirsten, who ran away from his home in Germany nearly 40 years ago. Today he is a graying professor of aeronautical engineering at the University of Washington, Seattle, holder of 70 patents, member of the Institute of the Aeronautical Sciences. Frederick Kirsten, an immigrant youth whose creative talents found expression on these democratic shores, believes that democracy can and will find the effective answer to the legions of Stukas and Messerschmitts.

But he adds a word of caution:

"Scientists," says this inventor, "cannot carry the burden of their work alone. Progress comes through years of painstaking effort and patience—often through costly experiments. Our Government must give full encouragement to all research which affects this country's welfare. We ask for no personal gain; only the chance of offering something useful to our nation."

Until the Nazi columns seared a path of destruction through Europe, military preparations in the United States were uncertain and limited. Inventor Kirsten's first contact with official indifference toward research of a defense nature came nearly twenty years ago. He had just invented the cycloidal propeller, had installed it successfully on marine craft and was deep in the task of adapting the device to aircraft. It was—and is—a strange-appearing rig. Revolving blades are locked to a rotating base on each side of his model plane. Wings are eliminated. Yet Kirsten estimates its potential speed at well over 500 m.p.h.

A Kirsten "sideline" invention was this famous cool-smoking pipe now on market.

Professor Kirsten is shown above with his rough model of an airplane having cycloidal propellers. He believes this propeller will revolutionize the present theory of flight.

Impractical? The late Gen. William ("Billy") Mitchell thought not. It was Billy Mitchell who pushed through the patent on the cycloidal propeller in the near-record time of three months. But that was back in 1921. In subsequent years General Mitchell stumped this country, preaching against indifference to the rapid development of aviation. And he was court-martialed for his prophetic utterances, for the voice of General Mitchell was only one voice raised in dissent against the prevailing inertia of the times.

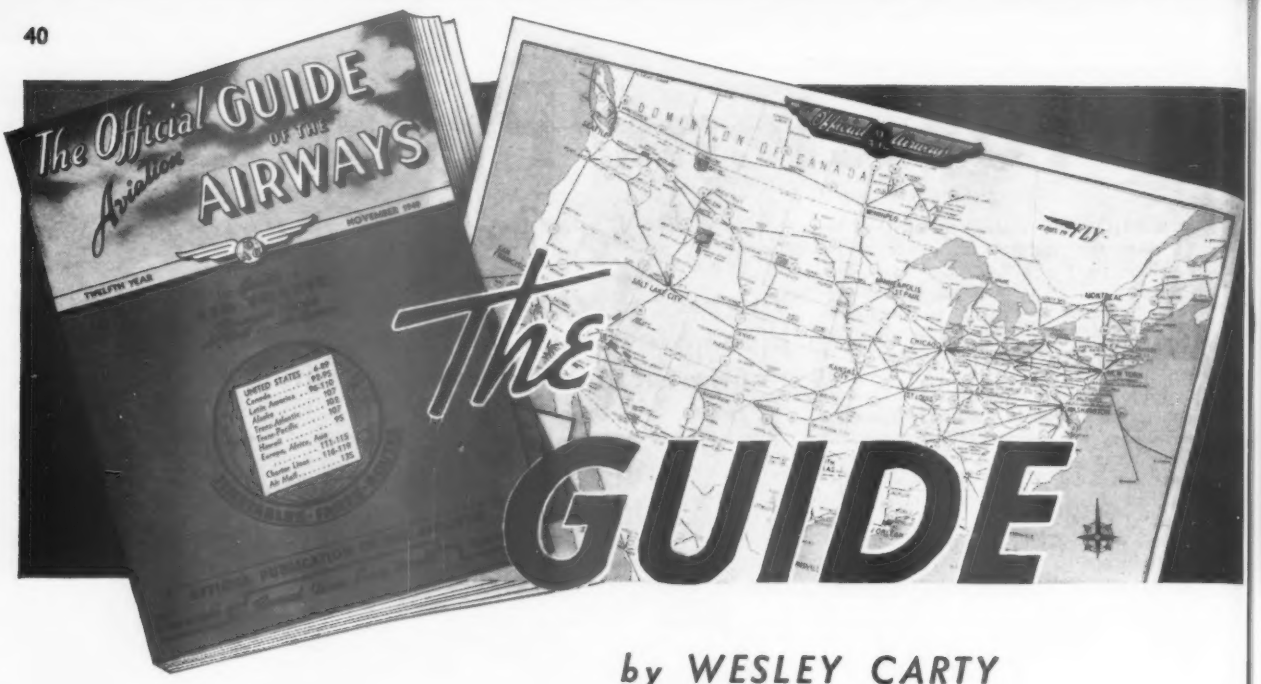
Even so, the dirigible *Shenandoah* was soaring westward in 1925. Its destination was Fort Lewis, near Seattle, where it was to get an experimental installation of the cycloidal propeller. Kirsten had proposed to eliminate the fin and rudder surfaces on the huge craft, placing the cycloidal propellers in sets of two at the stern and along the sides of the airship. He believed dirigible disasters could be traced to the inability of frames near the fin and rudder surfaces to stand sudden gusts of air. Furthermore, Kirsten assured navy officials, installation of his device would increase the airship's manueverability.

The *Shenandoah* never reached Fort Lewis. It crashed in Ohio and the United States Navy made no further effort to arrange a tryout for the quiet, determined Seattle scientist and his idea.

Frederick Kirsten, however, held a firm faith in the future of aviation. Over the disappointments of two decades he has financed his own research with proceeds from his patents. Probably you have heard of the Kirsten pipe, a duraluminstemmed and air-cooled smoking device which has done a very satisfactory business. The pipe and his other inventions, he reiterates, are only a side issue. The main task remains that of perfecting the cycloidal propeller for aircraft.

Aviation is the life and blood of the professor. It was largely through his foresight and insistence that the University of Washington today possesses one of the finest-equipped aeronautical research departments in the country. He pushed construction of a wind tunnel, largest on the Pacific coast. It has proven of inestimable value in experiments and instruction for hundreds of students. Today the department of aeronautical science at the University of Washington has an enrollment of

(*Continued on page* 68)



by WESLEY CARTY

Bible of the airline industry in the United States is the Official Aviation Guide. Its special maps and time tables are vital to the lines' daily work.

STEP up to the reservations desk of any airline, either in a downtown hotel lobby or out at the airport, and ask what trip you can get out tonight for Hawaii or Port au Prince. The attendant will whisk out from under the counter a blue covered book, flip a few pages and tell you.

But even if the information you seek is only about the next stop a few hundred miles down the obliging reservations clerks' own line, the blue book will appear. Even for that short haul it is dollars to doughnuts the blue book and *not* the line's own timetable will be consulted.

For, recognized as more dependable even than an airline's own timetables, is The Official Aviation Guide of the Airways—the blue covered book of magazine size that plays an inconspicuous daily role in the handling of passenger, air mail and air express traffic over the airlines of the nation and the world. Its 140-plus pages and its keyed map have become a bible to the traffic and passenger departments of 39 airlines; 19 of them in the United States and the remainder scattered over our insular possessions, Canada, Central and South America, the West Indies, Europe, Africa and Asia. Its average monthly circulation is a little over 5,000, all of it by mail; one major airline alone gets 693 copies every month.

Unknown to most air travelers is this printed navigator which plots their trips. But if they were to borrow the one their stewardess or steward produces en route to check their arrival time at a destination on some connecting line, they probably would do some eye rubbing. Unlike the frequently lampooned railroad timetable, the Official Aviation Guide can be understood. Cryptic symbols—like *‡ —*Stops only on Tuesday and Thursday to discharge passengers and then only on signal* are at a minimum. In a clear, standardized form—regardless of the line involved, whether it runs between Pocatello and Butte or San Luis Potosi and Torreon—trips and arrival and departure times are easily found and are understandable without deciphering. It is the Guide's proud boast that even the porter at an air terminal can produce one, a la Blackstone, from a hip pocket and tell you whether you will have time for a little nap aloft after luncheon.

Leonard A. ("Hogan") Hoogenstyn is the Guide's editor and expert cartographer.

The Guide is proudest of its keyed map, its one reference listing, revised monthly with each issue. Tipped inside the front cover, the two-page map furnishes at a glance the services between any two points, regardless of cities or companies involved, which the potential air traveler might choose for his trip. Should you want to go, for example, from Chicago to Ponca City, all you have to do is glance over the red-lined route and note that Number 51 will take you there. Table 51, when consulted, will not only solve your problem, but also that of anyone in New York, Washington or Detroit who wants

Constant pressure of business and the handling of ever-increasing numbers of passengers makes the airline reservations departments appreciate the Guide. It facilitates answering hundreds of queries.

to get to Ponca City. Or even go on from there to Mexico City.

Airline officials not only confirm the Guide's readability but admit that, for interline reservations and information, it is virtually indispensable to their passenger and traffic departments as a reliable source and a time saver. Officials of the Guide quietly credit all that to "experience in compiling schedule information in a comprehensive manner."

That is a silhouette of Official Aviation Guide today. Behind it lies a story old to the young aviation industry, but typical of the industry and its associated endeavors.

The Guide began business, like so many other aviation enterprises, on a shoestring 11 years ago. Its then light blue, plainly printed cover appeared in airline offices first in February, 1929. Today war has cut into its world-wide listings of schedules, slashed from its pages British Overseas Airways (formerly Imperial Airways), Air France and others, but the initial issue carried the rather abbreviated schedules of more lines than appear in its current issue. Its files should be a collector's item for an aviation bibliophile, the first issue listing such pioneer names as Canadian Western, National Air Transport, National Parks Airways, Varney Air Service and Boeing Air Transport.

The Guide expanded with the air transport industry; it recently added two pages to one line's listing and space limitations will force the same thing with another should it add one more flight. In the December, 1940, issue, for instance, American Airlines used 16 pages, United used 15, Pan American, 12; TWA, 11 and Eastern, 7. It has seen many names change in its index. It has missed but two issues of its monthly, completely revised editions—those of June and November, 1929.

Actively associated with the Official Aviation Guide from its beginning was a Chicago surgeon, Andrew Cosmas Garvy, its present president and general manager. An air travel enthusiast, Dr. Garvy, a Fellow of the American College of Surgeons and recently turned 62, is a senior surgeon at Chicago's St. Joseph's Hospital, medical director of the Illinois Industrial Commission and was, until recently, clinical professor of surgery at the Loyola University School of Medicine. A native Chicagoan, he is a graduate of St. Mary's College in Kansas and of Rush Medical College of the University of Chicago. Aviation, he says, is his "impelling hobby" and, through the Guide, he "realizes the consummation of an ambition to participate in the development and popularizing of air transportation." His fourth son (and fifth of his 10 children), Vincent F. Garvy, is assistant secretary of the Guide. Vincent and Edward K. Garvy, another son, are student pilots with solo certificates.

James R. Bremner, vice president, also has been associated with the publication since its beginning. He is a director of the American National Bank of Chicago and of the Bremner Bros. biscuit company. Secretary-treasurer of the corporation is William J. Lawlor, who recently retired as vice president of the First National Bank of Chicago. John R. Fletcher, another Chicagoan, was the Guide's first president and general manager. Stuart K. Chase succeeded him and was in turn succeeded two years ago by Dr. Garvy.

In the Guide's somewhat cramped office on the top floor of the old, weathered-brick, 22-story Transportation Building on Chicago's South Dearborn Street, with railroad traffic and freight agencies for downstairs neighbors, sits Leonard A. Hoogenstyn, editorial manager. A modest, careful, painstaking plodder of Dutch ancestry, "Hogan" has little chance to look out on the vista of Lake Michigan at his back when schedules start pouring in for the Guide's tentative 20th-of-the-month deadline. Actually, he will explain, that quite out of keeping with magazine practice, the deadline is a pliable thing, sacrificed for the sake of accuracy —postponed from its tentative setting so that 11th hour schedule amendments and revisions may be made by the airlines.

Even before their own timetables are released, when changes are to be made the airlines send them first to the Guide. Sometimes they come in as proofs from the airline's printers; sometimes they are typewritten or telegraphed changes which have not yet been incorporated into the line's own timetables. As a general rule the lines send the Guide their schedules first and worry about their own timetables afterwards, so dependable has become the blue covered book's service.

Guide work begins when the airlines' schedules flock in each month. The information is assembled on cross-ruled sheets in tabulated form that would confound a magazine editor, nonplus a newspaper make-up editor—both of whom used to the complications of layout sheets. Schedules supplied by the airlines are altered to conform with the more easily decipherable standard for the Guide's timetables. Then they check information.

Dr. Andrew C. Garvy

Checking Guide subscription lists above is Vincent F. Garvy, assistant secretary of the company and son of its president. All Guide circulation is handled by mail.

Traffic departments of the airlines are the Guide's best friends, but the Guide makes a clear distinction between friendship and accuracy. Every proffered schedule is checked. Times are inspected and suspected. Lines, like one recently, have been known to confuse A.M. and P.M. A "big three" line may submit (as one actually did) a schedule showing seven flights into New York from Chicago and only six westbound. What, the Guide editors had to know, happened to that extra DC-3? Was it deadheaded back to Chicago? The airline, after some head scratching, found it had seven trips westbound. Or, in a similar case, there were six trips in one direction between two northwestern cities, seven in the other. Again the Guide wanted to know what happened to the extra ship. "Huh," a line official said over the telephone, "you fellows don't miss a thing, do you? Our mail and express load on that unscheduled trip is so heavy we have to send a ship back without passengers." Quietly the Guide finds—and hopes the traffic departments will take no offense—from one to 100 errors in the schedules given it by each airline every month.

The schedules, checked out of the Guide's office, send printing costs soaring as monotype operators trip keys to set the type in greedily measured columns because of the complicated composition involved. Margin of error in this work is higher than in setting this line of type, hence proofreading at the printers' and back at the Guide is a tediously careful job. There are other complications. Just before the September issue went to press, for example, a pick-up air mail service was inaugurated in the east and new maps had to be made and listings altered.

The Guide does not take any chances. It holds its 144 or more pages—a tough production problem—"until the last second" for every possible change before the presses start rolling. Its only inviolate law is that its subscribers have next month's issue in their hands before the first of that particular month. Schedule changes which take place after the Guide has gone to press are corrected in supplements mailed to all subscribers. Usually they are sent far enough in advance so that the subscriber is not inconvenienced.

For their bible the airlines pay a nominal fee. The schedules and the advertisements that they run in it cost them a per page price which is far lower than the comparable advertising rate on an agate line basis they would pay in any magazine—regardless, the Guide maintains, of how low a magazine's rate may be. Object of the charge is to keep the lines interested in what they are buying. It works, and both ways. They cooperate eagerly. They also yell about what some competitor has claimed in advertising pages. Friendly, of course, but meaningly. It proves the Guide is read and, because it is, La Guardia Field, Hamilton Standard Propellers, Stinson Air Cab Service and others advertise in its limited advertising space. Other source of Guide revenue is, of course, its 50 cents a month selling price and its $5 a year subscription cost. But printing costs for the complicated production job are such—added to usual operating expenses—that the margin of profit is modest.

But the Guide does not rest alone upon its schedules for the Western Hemisphere, "every dependable airline in it," Pan American's transoceanic services and the remaining operating lines in other sections of the world. Its air express schedules are consulted daily by the Railway Express Agency and allied organizations for the dispatch of newspaper pictures and packages of every description. Air mail schedules are carried as a separate listing which refers the reader to the proper page and timetable of the line or lines involved. The Post Office Department, at first rather reluctant to supply air mail information, now eagerly sends the Guide all available data and all changes immediately. Now, Government cooperation has swelled a portion of the subscription list over which Vincent F. Garvy is watchdog.

The Guide also supplies the airline customer—and the reservations clerk—with fares between all points of the lines it lists; tells him how many pounds of baggage he will be permitted to carry free (some lines, particularly Pan American, have special allowances); clearly marks for him when he will get a free meal aloft and indicates what kind of a ship he will be flying in when he eats it; lists C.A.B. and Post Office officials and those of all the airlines for which schedules are carried; tells where airline ticket offices are located and just how much the limousine or taxicab fare from downtown to the airport will be.

In airways maps, the Guide has a distinct place. They are not for avigation purposes. Its four-color key map and its maps in black and white, carried alongside schedules and showing the routes, were only starters. Secure in its opinion that it was the chief source of up-to-date airline maps, the Guide has just published another four-color job, a 42x28-inch giant which shows, with their names, all of the airlines operating in the United States, southern Canada, Bermuda, Cuba, Haiti, Jamaica and most of Mexico. Like its timetables, its air mail and express schedules, the Guide plans constant revisions to keep the map up to the minute. In addition, the Guide has done many special jobs of map making for airlines and individuals. In collaboration with a leading map maker who furnishes the basic map, and with its store of airway information, the Guide claims it can do "special cartographing of any kind of air transport." Hoogenstyn, incidentally, makes most Guide maps himself.

With schedule listings as its mainstay and map making as a sideline, the Guide has monthly none-profit features which are of value to its steady airline subscribers. Its interline reservations guide, flying the "It Pays To Fly" logotype slogan of the Air Transport Association of America which is repeated throughout the Guide, is an invaluable, ready reference mine of information, code symbols, code reservation messages and designations for cities on airlines both within the United States and on international airways throughout the world.

No matter where you live, your local airline representative or travel agent will be able to tell you just what your passport and visa requirements are should you be thinking about that *Strato-Clipper* hop down to Rio de Janeiro with stopoffs at a couple of places en route. Not only does the Guide review the neutrality law restrictions on foreign travel for American citizens, but it gives standardized forms for health and police certificates—which are required, by the way, for any week-long visit to our "sister republics" to the south.

If you are interested in a trip like that, you can find where and in what city you can obtain a visa for your passport by digging back into this section of the Guide. It tucks away many interesting items worthy of a radio quiz program. At certain times, for example, when you fly into Hong Kong, the linen-uniformed British health officers will demand a cholera inoculation certificate before they will

(*Continued on page* 89)

At right is a recent picture of "Ham" Lee, just after flying his 3,000,000th mile.

Lee in 1923.

PATRIARCH

BY PASCAL COWAN

There are many old timers in aviation, but none is entitled to that sobriquet more than E. Hamilton Lee, the world's leading airman.

HE learned to fly in 1913 and was a veteran pilot when the United States entered the First World War. He's never had a serious accident, although he's flown 3,026,000 miles—more than any other man in the world.

He's E. Hamilton Lee, United Air Lines captain who has been flying the air mail 22 years and had, at this writing, a flight log of 21,670 hours in the air. His nearest competitor is Capt. Jack Knight, also of United, with 18,500 hours.

There a reason behind this remarkable record, and the reason is not "luck." Ham Lee treats flying as a business and he has kept up with the times. In early days when aeronautical science was in its swaddling clothes, Lee had one motto that he kept constantly in his mind's eye. It was: "When a plane stops flying it falls." He never fell. Today he has another motto. "A pilot must be an aeronautical engineer. Keep up with the times."

Many of his former buddies have fallen by the way because they have not been able to keep pace with the accelerated speed of modern avigation. They were content to continue flying by "the seat of their pants" until they learned too late that flying had caught up with and then passed them.

In the fall of 1913 a lanky farmer's boy in his 'teens, riding an old bicycle on the outskirts of Minneapolis, paused before a machine shop and thus changed the entire course of his life. Inside was a dilapidated pusher biplane about which a mechanic was tinkering laboriously.

"Gosh, I'd sure like to go up in one of those things," remarked the lad.

"Stick around for about three weeks and I'll give you a ride," replied the mechanic. "I oughta have the thing ready by then."

Ham Lee haunted the shed until the big day came. With his long legs hanging free and his arms wrapped tightly around a set of struts, he took his first flight—and found a life-long career.

The plane's pilot, A. T. Heine, who had graduated from the Curtiss Flying School in 1911, took an interest in the boy and soon taught him as much as was known at that time about flying. One day they heard that a tractor plane was being operated in Chicago. A plane with the motor out front was as radical a departure then as the Douglas DC-4 is today from the single-motored plane of a decade ago.

"Ham, we've got to keep up with the times," said Heine, establishing in the boy's brain a rule that was never forgotten. "We've got to learn to fly these new fangled things." They did. By the time the United States entered the war in 1917 the farm boy was a veteran aviator with more than 200 hours in the air. Volunteering his services, Lee was sent to Texas to *teach* the Army's flying instructors, who were in turn to teach America's flying fledglings.

It was while he was engaged in these duties that he made a discovery that once learned he never forgot.

"Most of the pilots were having trouble with what was known as a 'tight spiral'", said Lee. "I began to notice that the majority of spirals were caused by a lessening of speed. That principle is well known today but we had to learn for ourselves at that time.

"One day—in 1917—just before I was transferred to Selfridge Field to teach acrobatics, a cadet asked me to fly him through a 90° vertical spiral. I didn't believe I could do it. We took off and I began a right bank. Immediately I felt something go wrong. The controls didn't feel positive. Instinctively I nosed down and the plane came quickly under control. The cadet was mystified and so was I. I felt as though the plane had reacted itself in an effort to teach me something.

"I puzzled over it and deliberately slowed down the speed and let the plane 'fall off' to one side. Again I nosed down and the ship straightened out. It seems simple now but many a young pilot met accident and death because at that time few men

(*Continued on page 72*)

These American-built Sikorsky S-43 amphibians are part of the equipment of the Chilean national line.

Airline SOUTH of SOUTH

by MAJ. ARTURO MENESES
and Roland Birnn

Major Arturo Meneses of the Chilean Air Force, learned to fly in that country in 1926. In 1939 he took the U. S. Army Air Corps training courses at Randolph and Kelly Fields to study our methods of training military pilots and standards Army flyers must meet. Through special permission of the State and War Departments, he attended and recently graduated from the Air Corps Tactical School at Maxwell Field.

This is the story of the southernmost airline in the world. It was founded and is being operated by Chilean aviation pioneers, one of whom is the author of this article.

Major Meneses

IN Santiago I ran into a Yankee friend. The last I had heard he had been down to Puerto Montt, the southernmost part of what we Chileans think of as the mainland.

"Been down south?" I asked him.

"South? Art, I've been *south* of south. Down to the straits, to Punta Arenas or Magallanes or whatever you call that city. Thirteen hundred miles of tough weather, wicked country, worse waters, wild Indians, blizzards and gales all the way from P.M. to P.A. I thought our Alaska was tough but that part of Chile has it all beat. On the steamer there and back I kept thinking what a great thing it would be for you fellows to push an airline down there. Y'ought to see how P.A. has grown; a big boom town graduated into a real city. An airline would get all the business it could handle. But of course the country and weather are too tough for anything like that."

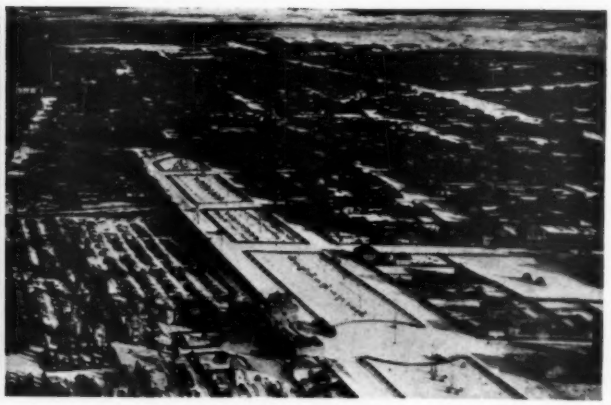
"Yes, I guess you're right," I sighed.

And then I could have kicked myself. Here was another doubter trying to convince me that something I hoped some day to see and to take part in was an impossible undertaking. Just a few days previously I had listened to a really great flying man describe his plans for an airways down into that country. Under the spell of his personality and ability I was convinced he would succeed, but my faith was rapidly going to pieces as I read the papers or listened to the wiseacres.

That was 11 years ago. Already an airline was operating from Santiago north to Arica and from then on up the West Coast. From Santiago a leg went south to Puerto Montt, the end of the mainland and the railroad line which runs through our long country. Yes, and even from P.M. an air *mail* line ventured south to Aysen, a new city and important cattle shipping center, recently colonized by the government. Colonel Arturo Merino-Benitez, Chief of Chile's Army Aviation, was instrumental in getting the air mail line down to Aysen. From that beginning he wanted a *scheduled* mail *and passenger* line to operate and operate safely. The irregular mail carrying planes were putting up a game fight running down from P.M. to Aysen; the pilots who didn't scare easily nevertheless felt that the flight was as tough as they could stand without subjecting passengers to the hazards. Colonel Merino insisted that a complete and scheduled line could operate in this 300-mile leg. He found his case tried in a number of pessimistic newspapers and by a multitude of obstructionists. The verdict was "it can't be done."

He adopted a new method of attack. In place of outward enthusiasm and eloquence he took the scientific approach. Admitting all the drawbacks he showed how these could be overcome or eliminated. He encouraged the waning enthusiasm of his pilots, members of the Chilean Army Aviation. He won over the Navy, the shipping people and finally the general public. He

This is Puerto Aysen, one of the original towns on the airline, in 1927. Today it is a progressive, growing community.



Punta Arenas, formerly known as Magallanes, is at the southern end of the line, just 250 miles by airline from dreary Cape Horn.

made studies of the weather and reconciled schedules with what little good weather might be found on that route. Weather forecasting was more difficult. This was over a decade ago before the general use of the air mass method of forecasting. Also we were on the West Coast with weather brewing out at sea where we had no observation stations.

The equipment was nothing to boast of; no more than were any planes back in 1929-30. We were using trimotored Fords, Fairchild J-5s and Junkers on the land route north from P.M. to the Peruvian border. On this Puerto Montt-Aysen leg, south of south, they used amphibians: 10 British *Vedettes*, a Loening and a Sikorsky. The Loening was the best but it held only four passengers. The Sikorsky would have been the answer but it couldn't stand the rough treatment. Those planes got plenty. The pilots, too, got plenty. Sometimes a pilot would get halfway down the line, run into an impassable storm, alight and anchor, then resume his flight when the weather had cleared, several times after a two or three day wait. They were a husky bunch, those pilots, true *Valientes*, with hands like foundry workers' from wrestling controls and handling anchor lines in freezing waters.

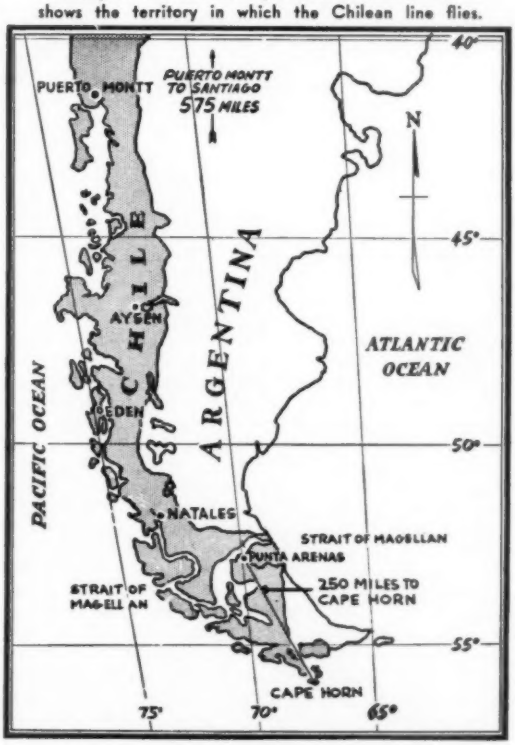
Among the pilots on this run were Captains Schaerer, Silva and Olmeda and Lieutenant Vidal. They flew in two-ship formation as far as possible. On one of these flights Schaerer and Vidal, each piloting a Vedette, detoured a storm and flew over land until a section of the inland waterways lay before them with the head of a blind canyon directly below their planes. The canyon was 800 feet deep; they were flying 1,200 more feet above the top of the cliffs. A terrific downdraught caught Vidal. Down into the canyon he went, although he had full power on and strove desperately to pull up and away. Inside the canyon his plane still settled and settled, powerless to pull away from the influence of that draught pouring over the cliffs, despite full flying speed ahead. Schaerer, helpless, saw Vidal's plane smack the water and disintegrate. The captain, for all the air currents, flew down into the canyon, landed in the turbulent tide rips and waves and then, seeing there was no one and nothing left to rescue, smashed his way into the air again and continued his flight. Colonel Merino was a pilot's pilot; he took his chances on that line with the rest of the boys.

By 1930, a year after it had started, the airline on this leg was firmly established and well patronized. The venture had cost the life of another pilot besides Vidal and injuries to other personnel. That was not a bad price to pay, except to the lads concerned. The line was a success; it ran on schedule, two or three round trips a week, and it carried mail *and* passengers. The shipping people found they were benefiting; the line was encouraging business travel and correspondence and Aysen was booming even as a resort town due to its majestic scenery and invigorating climate. The boom was increasing the trade by steamer in carrying heavy goods in and out of that port.

With that leg standing firmly, Colonel Merino kept his mind *south* of south. From Aysen to Magallanes, or to give it its original name and the one which it is again called, Punta Arenas. This leg was 900 miles. In spite of the success of the first route south from P.M. public sentiment did not give much support to the Colonel this time. If the flying weather was bad in the Aysen area, it was infinitely worse to the south.

It is cold, damp and tempestuous with prevailing winds from the northwest and west. If it blows hard from northwest, the wind is liable to shift suddenly round to the westward and blow still heavier, raising a mountainous and often a cross sea, especially so in semi-sheltered coves where a seaplane might anchor. The westerly gales do not last long, however, but shift round to the southward. Half the time the weather then clears up, but for a short time indeed. Easterly winds are of rare occurrence but are accompanied by fine weather. Westerly winds bring with them a constant fall of rain and a quick succession of hard squalls and showers. The velocity of the wind is greater in the southern part and occasionally reaches 100 m.p.h. This is in the vicinity of the western part of the Straits of Magellan. To quote from the *South American Pilot*, an official publication of the U. S. Hydrographic Office: "In this part of the straits the weather is undeniably bad, and it is probable that no portion of the globe frequented by man experiences, on the whole, worse weather. The total rainfall is doubtless greater in some other places, but it is confined to certain seasons, whereas in these regions it is impartially distributed throughout the year and there is absolutely

The map of the southern tip of South America below shows the territory in which the Chilean line flies.



The Chilean line was pioneered with planes like this single-engined, American-built Curtiss "Falcon." These ships were built under license by a Curtiss-Wright factory in Chile.

no fine season that is ideal for flying."

To top all this there is the rugged terrain, cliffs rising several thousand feet vertically from the water; mountains all around. The combination of sheer cliffs, high mountains, jumbled geography and high winds gave something to remember in air turbulence. The equipment, airplane and radio, didn't permit much flying over the top. The pilots had to take their chances under the low overcasts or around the fierce, sudden storms. In that 900-mile stretch few people lived, except in several small settlements in hidden coves. Otherwise there were none but a few trappers, outlaws and primitive, half-naked, cold resistant, canoe dwelling Alikaloofa Indians. One steamer ran to P.A. every four or five days.

Colonel Merino made the first flight himself in an old Junkers tri-motored bomber equipped with pontoons. He flew from Aysen to Eden thence to Natales. At the latter place, smashing into a huge sea on the take-off he broke the tip of one prop, but continued his whistling way to P.A. He showed the 900 miles could be made by air. Before word of his feat reached Santiago, however, tragedy struck hard.

Flying locally from P.A. several days after his arrival there, he ran into a bad storm and was forced to alight in a rough sea. The pontoons soon broke up. They radioed for help but before it arrived the plane had sunk. Four persons aboard were drowned, among them a Captain Fuentes, one of Chile's foremost pilots. Colonel Merino and the Intendente (Governor) of Magallanes were saved. When news of this tragedy reached upper Chile a generally pessimistic press and public became downright hostile; only a few supporters of the Colonel were in evidence.

Capt. Gunther Plueshow, a German World Was I. ace, hearing of this fantastic region, wanted to explore it by air. Making P.A. his base, he flew up and down the straits country in his Heinkel seaplane, writing a book about his experiences. Tragedy did not miss him either. Striking unusual turbulence on a flight over Lake Argentino the Heinkel's wings folded up; the whole machine just went to pieces in the air. Plueshow's photographer, Dreblow, made a safe jump via 'chute, landed in the lake, swam ashore and then froze to death on the bleak, windswept beach.

I had been flying passengers and mail on the line from Santiago north of Arica, an interested and loyal supporter on the P.M.-P.A. project. In December, 1930, Colonel Merino sent me with two other army pilots, a number of flight and base mechanics, several planes and some auxiliary equipment by steamer to P.A. From there we were to push *northward*, improving existing maps, establishing bases, laying out routes, until we linked up an airway with Aysen. December is summer down there. No, let's put it another way—June and July are the *winter* months. The word *summer* should not be used when describing that coast. In December the winds are worse than at other times of the year. It was dangerous work establishing a base even at P.A. due to the williwaws or sudden squalls of almost hurricane force. We put out stout moorings and buoys. We got our planes rigged up and flying; they were Curtiss *Falcons* with single pontoons. We fixed up a shop of sorts. We flew around locally for awhile, then we pushed northward.

Captain Fuentes

The charts, we found, while excellent for surface navigation, had to be revised for air use. We marked up one chart after another with weird hieroglyphics, showing sheltered anchorages, inviting but dangerous ones, possible haul-out beaches, landmarks easily spotted and identified from the air. We charted flying weather, the course and behavior of storms at different parts of the route. We tried some over-the-top operations with attendant tight moments and hours when we could not find a hole and had to stall down through, knowing that strong but variable and unpredictable winds had drifted us off our course perhaps into the mountains. In lonely coves we rubbed shoulders with hardy frontiersmen of south of south, with shifty customers, with the Alikaloofas.

The choice of Curtiss *Falcons* had been a wise one. They were among the first turned out in our Chilean factory. Not very desirable for bounce take-offs or smash landing in rough water they were nevertheless comfortable and safe flying planes with plenty of stability and reserve power once in the air. The 12-cylinder, V-type D-12 engine in each ship was a honey. We found bugs in our radio sets and revamped and repaired them. If it was not one thing it was another. Month after month blustered by.

At Port Natales and at Eden we established bases; buoyed moorings, a fuel and oil supply, a few men, some spares and shelter. At a few intermediate anchorages we cached gas and oil. We three pilots worked for several months then one was recalled. We two remaining ones worked for six more months. In October, 1931, I was the only pilot left on the project. The remaining mechanics and I plugged along for several more months until two more pilots were sent down.

Things moved slowly; the "expedition" was undermanned, and there was always the weather. We lost no lives, however, and our worst accidents were those that never happened although they came close to it. Finally in October, 1932, I was returned to Santiago, to El Bosque, the Randolph Field of Chile, where I was assigned as liaison officer. I had been down in the savage country for almost two years. The niceties of civilization, the comforts that everyone takes for granted, were novelties to me my first month at El Bosque. Punta Arenas is a good sized city it is true, but in those two years I had spent a lot of time in the wilds. Little was I to realize that, within two years, this airline would be carrying passengers at a rate of more than 11,000 a year and flying over 500,000 miles annually.

While I was at El Bosque the fellows I had left behind me kept up the good work, finally gettings things in such good shape that a few regular test flights were made between P.A. and P.M. Then, in September, 1934, came the big moment. It was time for the first *pay* hop. They picked me to make it. I left Santiago in a Sikorsky S-38. With me were the co-pilot, mechanic, radioman and one passenger. A huge load of mail, some of it all the way from North America, filled the cabin. I pulled her off at Santiago, landed at Puerto Montt and again at Eden, spending only a few minutes in each place refueling, and skipped Natales.

The arrival at Punta Arenas could not have been timed better. The city was celebrating Chilean Independence Day; my arrival there made it a double header. Looking back at it now, they put on one big party for us flying men down there in the straits city. A couple of days later I saw one of my original crew chiefs studying a wall chart. His eyes scanned the 250-mile stretch southeast of P.A. across the sheep ranches of Tierra del Fuego. You could almost see what was going through his mind. He pointed to Cape Horn and asked a question.

Colonel Merino

"When do we go, Captain?"

END

AIRCRAFT OWNERS AND PILOTS ASSOCIATION

AOPA NEWS

THE AOPA has just announced the appointment of Paul Goldsborough as radio advisor on our Technical Advisory Staff. Mr. Goldsborough is president of the Aeronautical Radio, Inc., a non-profit organization interested in aeronautical radio developments. He is a pioneer in the field of aviation radio. After completing his Army training he became the vice president of Universal Aviation Corporation and, prior to that, was prominent in the development (1929) of the old Northern Airlines, operating in the midwest. Later, after displaying a keen interest and aptitudes for the specialized field of aeronautical radio, he was persuaded by Herbert Hoover, Jr., of N.A.T. to go to Washington on these radio matters. That was in 1930. He still is there and doing a grand job. The AOPA is indeed fortunate to have Paul Goldsborough on its Technical Advisory Staff.

Radio Shopping

Prospective purchasers of aircraft radio receivers or airport transmitters (traffic control) should read the material in this month's AOPA Section (membership bulletin) about the proposed changes in airport control frequencies and the changes in equipment that this would entail, if the contemplated legislation is passed. Special negotiations now are under way to assist AOPA members in obtaining frequency checks. Read the future AOPA Section for details.

AOPA Offices Combined

The New York and Chicago offices of the AOPA have recently been combined at Chicago and the east coast interests now are being served from the Philadelphia AOPA office. This change was made in the interests of arranging better service facilities. Originally, office arrangements for AOPA were designed to handle a maximum of 2,000 or 3,000 pilots. Since that number now has more than doubled, the complete office set-up is undergoing a "streamlining process." The volume of mail, according to Doc Hartranft, AOPA's Executive Secretary, "has more than doubled in the last two months and the amount of individual servicing to members has also increased proportionately." Explaining that the present war conditions have excited abnormal interest in non-scheduled flying, Hartranft stated that the recent combining of office forces was in the interest of "giving better and faster service to membership." Since service to membership is considered by most people to be the keystone of the AOPA, this revamping process is expected to result in many new advantages in membership.

New AOPA Service

The first of a series of new and additional services to pilots registered with AOPA will be inaugurated some time this month when all members will receive a special AOPA-Hertz courtesy card. Read the AOPA Section for details. In general, this service will save members about $3 per 100 miles. When scheduling a trip, AOPA pilots may wire the Hertz station to reserve a car at destination. Upon arrival members may, up to a reasonable limit, take a taxi or bus to the station, and the amounts paid for the telegram and transportation will be deducted from car rental bill. This service is available to all registered AOPA pilots and applies throughout the United States and Canada. No deposit is required of members when applying for cars. A valuable feature of the service is the adequate and reliable insurance protection afforded, including Public Liability and Property Damage Insurance with limits of $5,000—$10,000 and $5,000 respectively and fire and theft as well. AOPA members will benefit by receiving a special commercial rate.

A pilot who used this service with any degree of regularity could more than pay for his AOPA membership ($5 per year.)

Data for AOPA Members

For many months AOPA officers have been working with officials of the Air Transport Association, official organization of the airlines, on problems affecting jointly both scheduled and non-scheduled aviation. We are happy to report that the ATA has been most co-operative. They have on all occasions met our requests more than half way. One of the many valuable activities of the ATA is the operation of the Engineering and Maintenance Committee. Periodically, this committee holds a closed conference during which the most detailed problems of aircraft, aircraft engine and aircraft accessory maintenance are discussed. The airlines, each represented by their expert maintenance men, the Army and Navy—as well as representatives of the manufacturers—meet and discuss specific questions which have been previously placed on the agenda by the interested parties. The whole procedure is transcribed by an elaborate system of dictaphone and microphone pick-ups. Later the word-for-word account of the conference is transcribed and distributed to the participating parties for permanent record. The AOPA has been accorded the privilege of sitting in on these important conferences. Much of the material applies to types of equipment which is exclusively airline operation and which would not be of particular interest to AOPA members. In other instances however we feel that the data is applicable to non-scheduled flying and private aircraft. We have arranged for a special report of the proceedings of the Engineering and Maintenance Conference, Air Transport Association of America (which was held at the Hotel St. Paul, St. Paul, Minnesota, July 15, 16 and 17, 1940) to be sent to all AOPA members.

We have gone through the entire proceedings and deleted those portions which applied to transport operations exclusively. *Note:* We regret that we can only send this report to registered AOPA members, and one copy per member only. We should like to have your comment on this issue as it will guide us in our future operations. Please let us know whether you find it interesting and helpful and if you would like additional reports.

An Explanation

The Roman numeral which appears below the wing and shield of the AOPA

Operators now can give newly-soloed students this attractive AOPA certificate.

lapel pin denotes the number of years the pilot had soloed an airplane. Each ensuing year the pilot is entitled to wear and, if a member in good standing, is provided with a tab showing one more year of experience. Consequently, this pin and tab is a constant visual record of the wearer's experience. Aircraft owners are entitled to wear the AOPA pin but *not* the tab unless they have also qualified as a pilot according to the foregoing. *Only certificated pilots or owners of aircraft and members in good standing are allowed to wear the AOPA insignia.*

Let's Play Ball

We know that the average pilot is willing to carry his share of responsibility and "play ball" when it is for the good of the team. That is why AOPA has gotten along as far as it has and why we think our group of pilots represent the cream of the country's pilots. Some fellows like to see the *other* fellow do all the work. That is always so and that is probably why some pilots have preferred to remain non-members. We're glad to say that this group is being reduced and the membership of the AOPA continues to soar. There are many reasons why we should like to have the vote of *all* licensed non-scheduled pilots. Take, for instance, the problem of airport restrictions and the general state of congestion at many points in the United States. Most pilots don't know that AOPA has been taking a leading hand in unraveling some of these complicated problems. Most pilots don't know that the chief pilots on the airlines have agreed to *start their approaches from a higher altitude* so as to make them more visible to non-scheduled flyers.

We would like all pilots to think twice when they are shooting on landing approach where there is scheduled airline traffic. *Give the scheduled pilot the break* if there is any doubt as to right-of-way — or even if there isn't. Most of us who have had experience in "hot" airplanes can appreciate the complicated procedures that airline pilots have to follow. Airline pilots do not have as much freedom of movement as the average "non-sked." Their ships are faster and less maneuverable. They have certain set procedures that they *must* follow. Also, let's don't forget the fact that they are usually carrying a greater responsibility: a cabin load of passengers. If *we* have to give it the gun and go around again—although sometimes annoying—it usually doesn't make a great deal of difference and there is a minimum of work; no gear to haul up, very little to trim and usually no tower contacting. The transports have a real headache on their hands if they have to go around again. If you don't think so, ask an airline pilot to show you a copy of his landing procedure "bible."

Let's be good fellows and play ball. *None of us want accidents.* There have been several very close calls. For the sake of mutual safety *all* pilots must cooperate.

Think—while you read the following four *actual* reports. If you operate around airline terminals, be on the alert —and give the transport the right-of-way. Personalities are not important; the cases are. We have therefore deleted the names and places in the following:

Case No. 1.

On August 27 Flight ——, Captain ——, Plane ——, departed —— a.m. and returned at —— a.m. account faulty microphone. When attempting to land on the SE runway the wind being SSE-6, a Taylor *Cub* No. NC —— owned by the —— Flying Service and flown by Instructor —with student making cross wind landings, cut in front of Flight —— making it necessary for Captain —— to go around and make a second approach in order to avoid collision. On questioning the owner and pilot of the plane, they advised that cross-wind landings were being practiced and that *they did not see our Flight* ——.

"Gosh, the laundry musta put too much starch in it! . . . "

This was taken up with the manager of —— airport and it was recommended to him that all planes using —— be required to have two-way radio.

Case No. 2.

On August 23 as Flight —— approached the field at —— at —— p.m. for a landing on the NE runway, a Rearwin NC —— had landed on the sod off the runway. Captain ——, flying Flight —— received his clearance to land from the control tower. The control tower advised the Rearwin pilot to hold his position on the ground until our trip —— landed. The pilot hesitated and then took off in a northeasterly direction, which course caused him to cross the NE runway. *The Rearwin crossed the runway above Flight —— and approximately 50 feet ahead.*

This matter was taken up with the manager of the ——municipal airport, with a copy to the regional manager of the CAA.

Case No. 3.

On July 30 our Flight —— had received a clearance from the control tower to take off to the N-W at —— the wind being north three to five miles per hour. After take-off had been started, a small ship was noticed in the S-W part of the field making a turn on the ground apparently in preparation for a N-E take-off. The small plane continued the turn and started his take-off directly across the path of our Trip ——. At this point it was too late for our pilots to reduce power, and the *pilot of the small ship saw our Trip —— in time to shut off power and ground loop the plane to avoid collision.* This matter was taken up with the Regional Manager of the CAA and the city.

Case No. 4.

Following is a copy of pilot's report in connection with an incident experienced by Trip —— involving small ships at —— municipal airport on August 1:

"To cite a specific example, on approaching—Tuesday morning, August 1, at —— a.m., I passed four small ships going north around the airport. Two other planes were to the north of the field approaching. The four ships going north were about 2,200 feet and *the pilots should have seen me go by,* however, by the time I had completed my turn for an approach they were all in front of me approaching. One of the small ships to the north pulled out and the other continued his approach on my right finally pulling out about 100 feet from the ground. I intended landing on the runway, however, the four small ships prevented this so I had to pull off to the right and land over the hangar.

"When I was ready to take off there were seven ships circling and landing so fast that it was impossible to get off without violating regulations which require giving way to landing planes." This matter was taken up with the regional manager of the CAA and city officials.

Safe Flying Rules

Under the date line of October 19, we note a bulletin issued by the Civil Aeronautics Board which, although now somewhat ancient, we think bears repeating. It reads as follows:

Bulletin

THREE BASIC RULES TO FLY SAFELY

1. Don't Stall
2. Don't Stall
3. Don't Stall

Certificate of Qualification

We have mentioned before in these columns the new solo certificate now available for distribution. Herewith we show a picture of the actual certificate. This

(*Continued on page* 88)

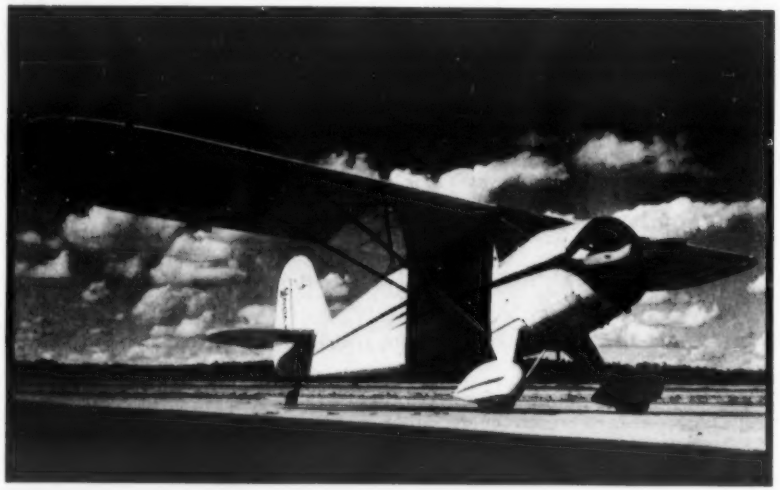
AERONCA
"Chief", 65-LA

Aeronautical Corporation of America — Middletown, Ohio

AERONCA
Tandem Trainer

Aeronautical Corporation of America — Middletown, Ohio

AIRCRAFT



REARWIN
Cloudster, 8125

Rearwin Aircraft & Engines, Inc. — Kansas City, Kansas

AIRCRAFT

REARWIN
Sportster, 9000KR

Rearwin Aircraft & Engines, Inc. — Kansas City, Kansas

AERONCA — TANDEM TRAINER

COSTS: List prices: 65 TL, $1,425; 65 TF, $1,490; 65 TC, $1,590. Minimum down payment: 65 TL, $475; 65 TF, $496.67; 65 TC, $530. Annual insurance premium: 9 to 15%. Operating cost per hour: $1.15.

PERFORMANCE: Miles per gallon of fuel: 24. Cruising speed at 75% h.p.: 90 m.p.h. Maximum speed at sea level: 100 m.p.h. Stalling speed: 35 m.p.h. Cruising range (excluding 10% fuel reserve): 250 miles. Service ceiling: 16,000 ft.

SPECIFICATIONS: A. T. C. No. 728. Type of airplane: CLM. Type of construction: Tubular steel fuselage, spruce spars and metal ribs. Engine: 65 TL, 65 h.p. Lycoming; 65 TF, 65 h.p. Franklin; 65 TC, 65 h.p. Continental. Fuel capacity: 12 gals. Weight empty: 700 lbs. Weight loaded: 1,150 lbs. Span: 35 ft. Height: 7 ft. 2 in. Length: 22 ft. 4 in. Wing area: 169 sq. ft. Wing loading: 6.8.

ACCOMMODATION: Number of seats: 2. Baggage: 40 lbs.

EQUIPMENT: Instruments (standard on this model): Airspeed indicator, oil pressure gauge, oil temperature gauge, tachometer, altimeter, engine primer and gasoline shut-off valve, carburetor heater. Other interior fittings: Complete upholstering. Propeller: wood, fixed pitch.

REARWIN — Sportster, 9000KR

COSTS: List price: $3,295. Minimum down payment: $1,098.33. Annual insurance premium: $525. Operating cost per hour: $3.85.

PERFORMANCE: Miles per gallon of fuel: 20. Cruising speed: 115 m.p.h. Maximum speed at sea level: 125 m.p.h. Stalling speed: 38 m.p.h. Cruising range (excluding 10% fuel reserve): 500 miles. Service ceiling: 15,000 ft.

SPECIFICATIONS: A. T. C. No. 591. Type of airplane: CLM. Type of construction: Welded chrome steel tubing, fabric-covered. Engine: 90 h.p. Ken-Royce 5F. Fuel capacity: 24 gals. Weight empty: 830 lbs. Weight loaded: 1,460 lbs. Span: 35 ft. Height: 6 ft. 9 in. Length: 22 ft. 3 in. Wing area: 166 sq. ft. Wing loading: 8.8.

ACCOMMODATION: Number of seats: 2. Baggage: 50 lbs.

EQUIPMENT: Instruments (standard on this model): Airspeed indicator, altimeter, tachometer, oil pressure gauge, oil temperature gauge, switch, 2 fuel gauges.
Other equipment: Carburetor heater, brakes, parking brake, NACA cowl, pressure baffling, carburetor air cleaner, tail wheel, fire extinguisher, tool kit, two luggage compartments, dual controls, engine manual, first aid kit.
Deluxe equipment: Ball bearing cabin controls, luggage compartment under seat, speed wing tip, controls under floor.
Extra equipment: Cabin heater, navigation lights, battery, radio, float fittings, electric starter, special instruments, wheel pants, skis, floats.
Propeller: wood, fixed pitch.

AERONCA — "Chief", 65-LA

COSTS: List price: $1,695. Minimum down payment: $565. Annual insurance premium: 9 to 15%. Operating cost per hour: $1.15.

PERFORMANCE: Miles per gallon of fuel: 25. Cruising speed at 75% horsepower: 95 m.p.h. Maximum speed at sea level: 105 m.p.h. Stalling speed: 38 m.p.h. Cruising range (excluding 10% fuel reserve): 350 miles. Service ceiling: 15,000 ft.

SPECIFICATIONS: A. T. C. No. 702. Type of airplane: CLM. Type of construction: wood, metal, fabric. Engine: 65 h.p. Lycoming 65B. Fuel capacity: 12 gals. Weight empty: 720 lbs. Weight loaded: 1,250 lbs. Span: 36 ft. Height: 6 ft. 3 in. Length: 21 ft. Wing area: 169 sq. ft. Wing loading: 7.4.

ACCOMMODATION: Number of seats: 2. Baggage: 70 lbs.

EQUIPMENT: Instruments (standard on this model): tachometer, oil temperature gauge, oil pressure gauge, altimeter, airspeed indicator.
Interior fittings: leatherette upholstery, cabin heater, carburetor heater, spinner, first aid kit, fire extinguisher, log books, engine manual, wings wired for navigation lights, dual controls, dual safety belt, carpet, primer and two doors.
Propeller: fixed pitch, wood.

REARWIN — Cloudster, 8125

COSTS: List price: $4,295 (three-place, $4,495). Minimum down payment: $1,431.33. Annual insurance premium: $680. Operating cost per hour: $5.10.

PERFORMANCE: Miles per gallon of fuel: 18. Cruising speed: 125 m.p.h. Maximum speed at sea level: 145 m.p.h. Stalling speed: 48 m.p.h. Cruising range (excluding 10% fuel reserve): 625 miles. Service ceiling: 17,000 ft.

SPECIFICATIONS: A. T. C. No. 711. Type of airplane: CLM. Type of construction: Welded chrome steel tubing, fabric-covered. Engine: 120 h.p. Ken-Royce 7F. Fuel capacity: 34 gals. Weight empty: 1,040 lbs. Weight loaded: 1,735 lbs. Span: 34 ft. 1½ in. Height: 7 ft. 4 in. Length: 21 ft. 6 in. Wing area: 161.8 sq. ft. Wing loading: 11.125.

ACCOMMODATION: Number of seats: 2; also available as three-place ship. Baggage: 50 lbs.

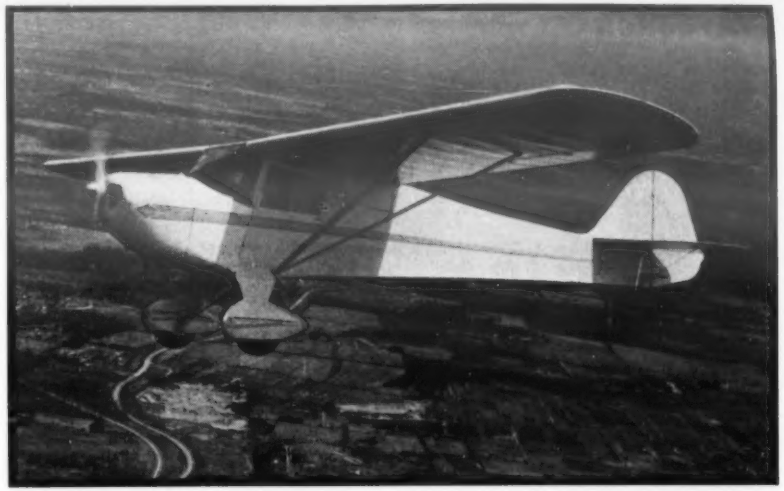
EQUIPMENT: Instruments (standard on this model): Airspeed indicator, altimeter, tachometer, oil pressure gauge, oil temperature gauge, compass, switch, two fuel gauges.
Other equipment: Exhaust manifold, carburetor heater, NACA cowling, altitude mixture control, Plexiglas windshield, brakes, parking brake, eight-in. tail wheel, navigation lights, six-volt battery, ball bearing controls throughout, two cabin doors, dual controls, complete cabin upholstery, luggage compartment, fire extinguisher.
Extra equipment: Cabin heater, generator, landing lights, radio, electric starter, flares, float fittings, special instruments, wheel pants, metal propeller.
Propeller: wood, fixed pitch.

AIRCRAFT

STINSON
"105"

Stinson Aircraft — Wayne, Michigan

AIRCRAFT



TAYLORCRAFT
BC-65

Taylorcraft Aviation Company — Alliance, Ohio

AIRCRAFT

WACO
Airistocrat, H. R. E.

Waco Aircraft Company — Troy, Ohio

AIRCRAFT

WACO
Y. K. S.

Waco Aircraft Company — Troy, Ohio

TAYLORCRAFT — BC-65

COSTS: List price: $1,835. Minimum down payment: $666.71. Annual insurance premium: $165.15. Operating cost per hour: $1.23.

PERFORMANCE: Miles per gallon of fuel: 27. Cruising speed at 75% h.p.: 95 m.p.h. Maximum speed at sea level: 105 m.p.h. Stalling speed: 35 m.p.h. Cruising range (excluding 10% fuel reserve): 250 miles. Service ceiling: 17,000 ft.

SPECIFICATIONS: A. T. C. No. 696. Type of airplane: CLM. Type of construction: Welded tubing. Engine: Continental A-65-7 or A-65-8. Fuel capacity: 12 gals. weight empty: 640 lbs. Weight loaded: 1,150 lbs. Span: 36 ft. Height: 6 ft. 8 in. Length: 22 ft. Wing area: 167 sq. ft. Wing loading: 6.88.

ACCOMMODATION: Number of seats: 2. Baggage: 30 lbs.

EQUIPMENT: Instruments (standard on this model): Tachometer, oil pressure, oil temperature, airspeed, altimeter, gas gauge.

Interior Fittings: Bedford cord, or leatherette upholstery, carpet, two doors and windows, two adjustable ventilators, dual controls, first aid kit, fire extinguisher, engine manual, carburetor heater, log books and spinner.
Propeller: wood, fixed pitch.

WACO — Y. K. S.

COSTS: List price: $7,985. Minimum down payment: $2,659. Annual insurance premium: 9.75% of list price. Operating cost per hour: not available.

PERFORMANCE: Miles per gallon of fuel: 10. Cruising speed at 70% h.p.: 135 m.p.h. Maximum speed at sea level: 144 m.p.h. Stalling speed: 55 m.p.h. Cruising range (excluding 15% fuel reserve): 518 miles. Service ceiling: 12,500 feet.

SPECIFICATIONS: A. T. C. No. 626. Type of airplane: CLB. Type of construction: Wood, metal and fabric with mahogany plywood linen covered wings; welded steel tubing, linen covered fuselage. Engine: 225 h.p. Jacobs L4. Fuel capacity: 70 gals. Weight empty: 1,945 lbs. Weight loaded: 3,250 lbs. Span: 33 ft. 3 in. Height: 8 ft. 4 in. Length: 25 ft. 4 in. Wing area: 244 sq. ft. Wing loading: 13.32.

ACCOMMODATION: Number of seats: 5. Baggage: 100 lbs.

EQUIPMENT: Instruments (standard on this model): Altimeter, air speed indicator, compass, electric fuel gauges, oil pressure gauge, oil temperature gauge, tachometer, volt ammeter, electric starter, 15 ampere generator, navigation lights, indirectly lighted instrument panel with rheostat control, all instruments mounted in shock-proof panel supported by Lord bushings. Interior fittings: Fabricoid trim with wide selection of colors, broadcloth optional, adjustable front seats, ash trays, toe-operated hydraulic brakes, parking brake, dual rudder pedals, throwover control wheel, fire extinguisher, tie-down ropes.
Propeller: metal, fixed pitch.

STINSON — "105"

COSTS: List price: $3,370. Minimum down payment: $1,123. Annual insurance premium: $337.00. Operating cost: .061 cents per plane mile.

PERFORMANCE: Miles per gallon of fuel: 22.1. Cruising speed at 85% horsepower: 109 m.p.h. Maximum speed at sea level: 111 m.p.h. Stalling speed: 43 m.p.h. Cruising range (excluding 10% fuel reserve): 398 miles. Service ceiling: 12,000 ft.

SPECIFICATIONS: A. T. C. No. 709. Type of airplane: CLM. Type of construction: wood, metal, fabric. Engine: 80 h.p. Continental A-80. Fuel capacity: 20 gals. Weight empty: 923 lbs. Weight loaded: 1,580 lbs. Span: 34 ft. Height: 7 ft. 2 in. Length: 22 ft. 2 in. Wing area: 155 sq. ft. Wing loading: 10.2.

ACCOMMODATION: Number of seats: 3. Baggage: 24 lbs.

EQUIPMENT: Instruments (standard on this model): airspeed indicator, altimeter, compass, tachometer, oil temperature gauge, oil pressure gauge, fuel gauge.
Propeller: wood, fixed pitch.

SPECIAL FEATURES: slotted flaps, fixed wing tip slots.

WACO — AIRISTOCRAT, H. R. E.

COSTS: List price: $14,200. Minimum down payment: $426.42. Annual insurance premium: 9.75% of list price. Operating cost per hour: not available.

PERFORMANCE: Miles per gallon of fuel: 10. Cruising speed at 70% h.p.: 168 m.p.h. Maximum speed at sea level: 177 m.p.h. Stalling speed: 60 m.p.h. Cruising range (excluding 15% fuel reserve): 1,080 miles. Service ceiling: 16,000 feet.

SPECIFICATIONS: A. T. C.: No. 714. Type of airplane: CLB. Type of construction: wood, metal and fabric with mahogany plywood, linen-covered wings, welded steel tubing, linen covered fuselage. Engine: 300 h.p. Lycoming R-680E3. Fuel capacity: 125 gals. Weight empty: 2,572 lbs. Weight loaded: 4,001 lbs. Span: 34 ft. 9 in. Height: 8 ft. 8 in. Length: 27 ft. 10 in. Wing area: 246 sq. ft. Wing loading: 16.25.

ACCOMMODATION: Number of seats: 5. Baggage: 100 lbs.

EQUIPMENT: Instruments (standard on this model): Altimeter, airspeed indicator, bank and turn, rate of climb, compass, electric fuel gauges, manifold pressure gauge, oil pressure gauge, oil temperature gauge, tachometer, carburetor and outside air temperature gauge with selector switch, single lead thermocouple, volt ammeter, electric starter, 15 ampere generator, navigation lights, landing lights, all mounted on shock-proof panel supported by Lord rubber bushings, instruments indirectly lighted with rheostat control. Other interior fittings: Toe-operated hydraulic brakes, dual rudder pedals, throwover control wheel, cabin heater and ventilators, front seats adjustable fore and aft, automobile type spring base with finest curled hair cushions covered with finest Laidlaw broadcloth, ash trays, assist cords, rear seat arm rests, tool kit, first aid kit, fire extinguisher, tie down ropes, rear seat reading lights, map light for front seats.

SPECIAL FEATURES: Electrically operated flaps, Waco-type enclosed engine cowl with pilot-controlled ventilator, giving correct motor temperature control.
Propeller: metal, controllable pitch.

by WILLIAM HURD BARRETT

WE'VE had quite a few letters this month from readers who want information on how to go about getting specific jobs. Keep up the good work! Your letters are the only way we have of finding out what you want to know. Incidentally, we're going to try to answer them in such a way as to give the information you've requested not only to you personally, but also to the hundreds of other readers that *didn't* write in who are in precisely the same positions you are.

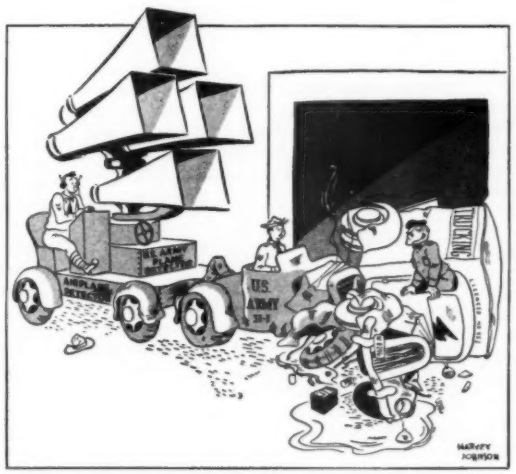
This is how we're going to work it. We're going to group the letters under their respective job classifications and answer each such group of letters as a unit—placing over each reply the initials of those of you who have written us regarding that job classification. That, of course, is so you can tell when your letter is being answered. We'll try this a while and see how it works. . . .

* * *

Perhaps the most interesting letter we had was from W. H. Wainwright, of Sarasota, Fla. Mr. Wainwright asked us something we've been wondering about for some time. He says: "There are thousands of talented young men who would do anything to get into aviation but who are financially unable to get the training needed. My idea is for the aviation schools to give this training on a credit plan. Let the student pay, after he finishes the course, in monthly installments. And if the schools can't finance it, why not have the Government finance the schools?"

That seems like a good idea, on the face of it. If a man can buy a radio or a suit of clothes on the installment plan, why shouldn't he buy vocational training the same way? . . . Well, we took a run over to one of the schools near Los Angeles and asked the registrar what the catch was. And we found out. The registrar told us that, for over a year, their school had offered an aircraft sheet metal course in which the tuition was payable on the installment plan. Unfortunately, he said, their credit experience was so bad they had to give it up. He explained that most of the men who asked for credit were in such sad financial condition they couldn't make deferred payment contracts for merchandise and had no regular incomes or assets. The only security they had to offer, in other words, was the job they might get after finishing their course. Here was the unfortunate part of it: the registrar showed us figures on collections from men the school had placed in three aircraft factories. Over 40 per cent of them showed delinquent balances and were uncollectable by reason of the fact that if any attempt were made to collect the money by legal means, the factories concerned would lay the men off. Large companies don't like garnishees. The bookkeeping and trouble involved costs them money. So, credit was out.

The registrar also said that any man with a good credit rating could get training without paying cash for it by obtaining a bank loan—with or without co-signers—for the full amount of the tuition. The bank loan could be paid off in monthly installments. He added that he would give anything in the world to be able to do credit business, since it would increase his potential enrollment by several hundred per cent, but that so far he hadn't been able to figure out any way to do it profitably. You can't, he said, repossess a training course.



"S-sorry, er, mister. I didn't hear you blow your horn . . ."

Just to make sure, we checked at another school to find out if this information was correct. It was. The second school said, though, that they didn't entirely blame the men involved, as it was hard enough for a man to get along on beginner's wages without having to pay back a couple of hundred dollars he'd contracted for before going to work. Too, they'd found that unless students had their courses paid for, they'd often become discouraged and drop their training halfway through the course. They prefer, in any event, to have their students sufficiently well off to live without hardship while they are training.

Both schools, though, did have scholarship plans through which students could work off a good percentage of their tuition and they would also make special arrangements whereby students could pay for training in installments while they were going to school, so long as the full tuition was paid before graduation. We believe that this is pretty generally the situation.

One good bet many men have missed is the free vocational training for adults that is given by the public schools. In Southern California and other places where aircraft factories are concentrated, these public trade schools give excellent free training in many subjects—including aircraft sheet metal—that will prepare students for jobs in the industry. Ask the principal of your local high school for information on adult education courses. He will know about them, or can find out for you.

As to Government-financed training, one of the schools we visited was training Army enlisted men whose tuition was being paid by the Government. All these men, however, were serving three-year Army enlistments. It's too early yet to determine whether conscripted men who apply for Air Corps assignments will be given ground school mechanical training, although it seems likely they will be.

We also dropped in on C.A.A. civilian flying division officials who said that they offered no courses for aircraft mechanics, but who referred us to the National Youth Administration. N.Y.A. men said they were operating two training projects in Southern California in cooperation with two of the local manufacturers. Any intelligent male between the ages of 18 and 25, who is an American citizen and in good physical condition, is eligible to apply for a five weeks' training course in aircraft sheet metal, with an excellent chance for employment at the end of his course. He must be recommended by the National Youth Administration office in his district and must be passed, prior to enrollment, by the school instructor—who tries to pick men who will be acceptable to the manufacturers. During the five-week training period, the Federal government pays students *pro rata* at $18 a month, from which they are required to pay about $5 for essential hand tools which become their property. The course consists of 40 hours of study and 40 hours of work.

To our question as to whether this training was being given throughout the country, the local office said it didn't know and suggested we tell interested persons to write their state N.Y.A. office for information. We also asked whether there would be further expansion of such training in connection with the defense program, and were told that there probably

would be. We'll keep in close touch with this situation and let you know the moment that anything develops.

* * *

Letters from R.L., of the Bronx, N. Y., and H.S.H., of Menomonie, Wis., asked about their chances of employment as draftsmen. These men both are trained and experienced and seem well qualified. R.L. is a college graduate who majored in statistics and higher mathematics and has done statistical drafting. Here's what we'd suggest for him. Near his home in New York are the following large plants: Curtiss-Wright and Bell in Buffalo; Brewster in Long Island City, and Martin in Baltimore, Md. We believe if R.L. writes the personnel departments of the above plants a letter very similar to the one he wrote us, itemizing his training and experience and asking if, in their opinion, he is qualified for work in budgeting, scheduling, estimating, weights and balance calculation, statistical drafting, detail drafting or template layout, he will get an answer from at least one of them—particularly if he says that he can, without financial hardship to himself or obligation to them, come into their offices for a personal interview.

H.S.H. is at somewhat of a disadvantage, due to the fact that he lives far away from the main aircraft production centers. As we have said before, no company will ask a man to come long distances on the off-chance of employment. His qualifications, apparently, are of the best and, if he lived near one of the manufacturing centers, he would have a good chance of getting employment. Since he is married, however, we would emphatically advise him not to make any move that would jeopardize him or his family. If he is able to finance a trip to one of the manufacturing centers, he might try the letter technique we advised in R.L.'s case—except that he should say he is going to make a trip to the vicinity of the companies he is writing and that, while he is there, he would appreciate an interview. . . . Incidentally, why doesn't he try some of Wisconsin's heavy industries? They use draftsmen, too.

* * *

W.J.W. of Columbus, O., also is interested in obtaining work as a draftsman. He has had two years of college training in mechanical engineering drawing, as well as higher mathematics. He is fairly well qualified and should be acceptable as a detail draftsman or a template layout man, depending, of course, on the demand for inexperienced men. We do not, off hand, know of any aircraft plants in his state with the exception of Aeronca in Middletown and Taylorcraft in Alliance, although we feel certain that there must be others. In his case, we believe it would be best for him to apply personally to the employment office of one of these concerns. We recommend letter writing only in cases where men have had actual experience in the work for which they are applying, or where they have had exceptional educational advantages. Ordinarily, there is an ample supply of inexperienced labor to be found locally,

(*Continued on page* 80)

Why Not?
Sirs:

. . . I learned to fly in September, 1937, and have logged a number of hours by flying my own ships. In connection with this so-called C.A.A. program, I would like to know why the Government takes these young men and women, that do not know a rudder from a piston, and teach them to fly at practically no expense to them. Now, in this part of the country I know a number of young fellows like myself who learned to fly by working hard and by spending all they made to learn to fly. Every one had his time in a 2S rated ship—and not a 1S corn-popper. What good is a 1S pilot to handle the controls of Government ships? Why can't the Government give us a little more training in advanced ships? We already know how to fly but there is a lot more we need. Why cannot we have this training? We are paying taxes too.

LYLE MILLER.

Elyria, O.

● Reader Miller should read his copies of FLYING AND POPULAR AVIATION more carefully. The Civilian Pilot Training Program of the C.A.A. has, for several months, been training a certain percentage of non-college, as well as college, men and women, both in primary and secondary flying. Has Mr. Miller applied to his nearest C.A.A. regional office for information?—Ed.

Technicalities
Sirs:

I read, with some interest, B. Orchard Lisle's article on aviation fuels (October, 1940). There are numerous errors in the article . . . Neohexane tests 92 octane ASTM, not 95 to 100 as mentioned. It has 50 per cent boiling point of about 120° F, too low for its use as a straight fuel. However, it might be blended with iso-octane, which certainly has a high boiling range. The advisability of some of the fuels mentioned being used is certainly a moot point. Moreover, the CFR-ASTM method is not accurate for fuels over 90 octane. How do you propose to test a 115 octane gasoline? And how did Dr. Gustav Egloff get his 125 octane rating for his costly triptan? . . . Research workers had better not rest on their laurels as they are, from the inspection of the data presented in the above-mentioned article. The United States has very little high-octane gasoline which is not leaded as much as feasible. Any automobile mechanic will tell you how lead coats the exhaust valves of automobiles. The aviation base stock (usually 74 to 80 octane ASTM), plus 6 cc of TEL per gallon, must certainly coat aircraft valves badly. . . .

MORGAN G. SMITH.

Wallingford, Penn.

● Can Author Lisle or some other expert on fuels give Reader Smith an explanation?—Ed.

Idea
Sirs:

I would like very much to see some articles on the first 35 hours of flying. I have almost eight hours of flying time. . . . Since I have been flying, I have talked four boys into taking lessons . . . and I believe some article on the first few hours of flying would help a lot of boys take the first step. I know I have experienced so much I could write a book about my first eight hours—and those first eight hours have been more interesting than flying across the Atlantic. In others words, I would like to see you start a beginners' department. . . .

JOHN G. CHANDLER.

Decatur, Ga.

● What do *you* think, pilots?—Ed.

British Magazines
Sirs:

The write-ups U. S. aircraft have been given in the British "flying magazines," *Flight* and *The Aeroplane* . . . are very false and highly inaccurate. Some of the comments and general remarks they make on U. S. aircraft are utterly ridiculous. Presumably, the ideas of *The Aeroplane* and sometimes *Flight* (the latter is not as bad as *The Aeroplane*, which calls itself "The Most Influential Aviation Journal in the World"!) are to keep the American airplanes out of the British market at any price and, because of this, they have resorted themselves to publishing cheap, anti-U. S. aircraft propaganda . . . This must be funny when read in those foreign countries—and the British Empire—who have been using American aircraft for years in their air forces and air transport routes. . . .

The expressions of disgust and amazement toward our purchasing commission in America, when it was announced that we would be purchasing thousands of U. S. aircraft for our air force, was terrific in *The Aeroplane*. They said the Bell *Airacobra* could not be regarded as a serious fighting airplane, as it was inadequately armed! Yet that ship has eight machine guns and a .37 mm cannon! . . . Apparently *The Aeroplane* has overlooked the fact that several types of obsolete British airplanes are still in active service and come into combat with vastly more modern German planes. For example, the Avro *Anson*, Gloster *Gladiator*—even Hawker *Fury* fighters and *Hart* bombers have gone into action. . . .

. . . I hate having to write in this manner as a patriotic Britisher but, as a keen student of international aviation, I am interested in only the plain, common truth.

DENNIS M. POWELL,
President, Westcliff Aviation Club.

Rochester, Kent,
England.

● Particularly noted for its many inaccurate statements about American aircraft, *The Aeroplane* has nevertheless calmed down slightly since the sudden departure of its veteran, Yank-baiting editor, C. G. Grey. If either *Flight* or *The Aeroplane* really represented official British views, Air Ministry officials should

(*Continued on page* 85)

CONTROL SURFACE MECHANISMS

by RAOUL J. HOFFMAN

THE mechanism for actuating control surfaces is usually a combination of machine elements. They are arranged in such a manner that the motion of one compels the motion of the control surface, according to a definite law depending on the nature of the combination used.

The simplest element and the easiest to manufacture is the link or lever. Its simplicity is the reason for its general use in control designs. Forces acting on the controls should be investigated for various positions of the control surfaces. Three sketches in Section 1 show that a 100-pound load may exert a force ranging from 100 to 1,000 pounds in the push rod. To prevent the control unit from getting into an unwanted position, stops are provided to limit the control motions.

A law of mechanics states that work delivered and work received, neglecting friction, must be of equal magnitude. And work to be equal force times the distance through which it acted. For example, if the load of 100 pounds on the surface is moved over a distance of one inch and at the same time the control rod moves only ½-inch, then the force in the rod will be 200 pounds.

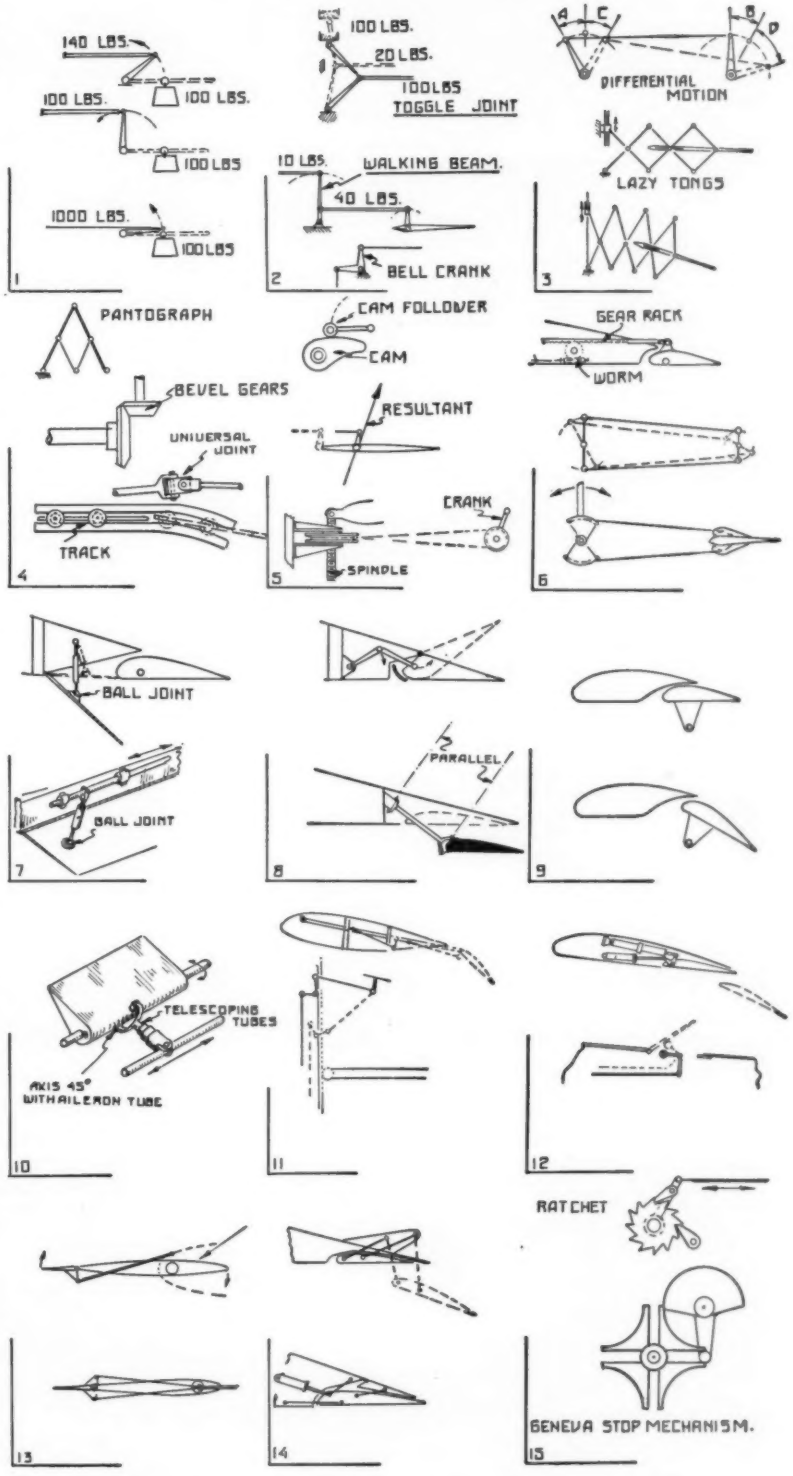
More convenient is the law of moments which states that the control moment must be equal to the moment created by the load on the control surface. Moment being defined as the force times the shortest distance to the common axis.

The center sketch in Section 5 shows the resultant force passing through the hinge line. There will be no load on the control rod. A flutter however, may result at high speeds if the bearings have a loose fit. Moving the axis to the leading edge the force required to hold the control surface will increase considerably. Usually a certain "feel" is wanted in a lightplane and in high-speed ships. For long range or commercial ships this is not a requirement.

The mechanism pictured in the upper sketch in Section 2 is a toggle joint. It is used when a load or moment from the control surface increases rapidly. The toggle joint has an advantage to lock itself by its own load. If the direction of the control is changed or the distance between the fulcrums is too great an intermediate oscillating arm, a walking beam (Section 2) is used. It reduces the weight of the push-and-pull control rods. If the transmission angle is large (close to 90°) then a bell crank, as sketched in Section 2, is employed.

Levers of equal lengths and parallel to each other will give equal angular displacements. If they are not parallel then their angle of rotation varies as indicated in a sketch in Section 3. This design is usually used in aileron controls to equalize the yawing moments for the up and down movements. A unit made of a series of interconnected links shown in Section 3 is called the lazy tongs. They

(*Continued on page* 78)



The above diagrams illustrate the various control surface operating devices.

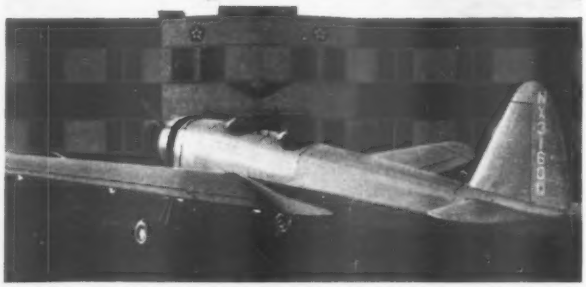
HAVE YOU SEEN ?

Latest version of Curtiss-Wright CW-20 is shown in top photo. New change is single tail. The picture directly above shows ship's original twin-ruddered tail assembly.

First of the new Douglas attack-bombers for the Army Air Corps is A-20A above. It is similar to British DB-7. Engines are two 14-cylinder Wrights, three are in crew.

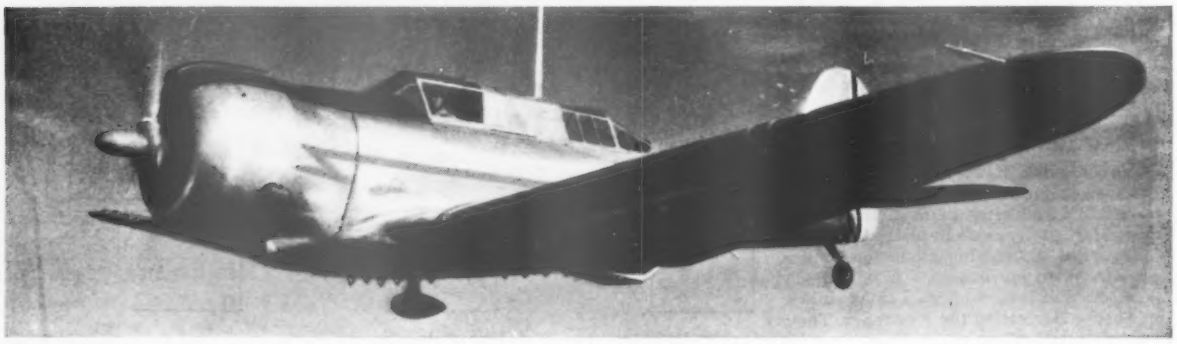
British engineers above are examining a shot-down German Junkers Ju-88 bomber.

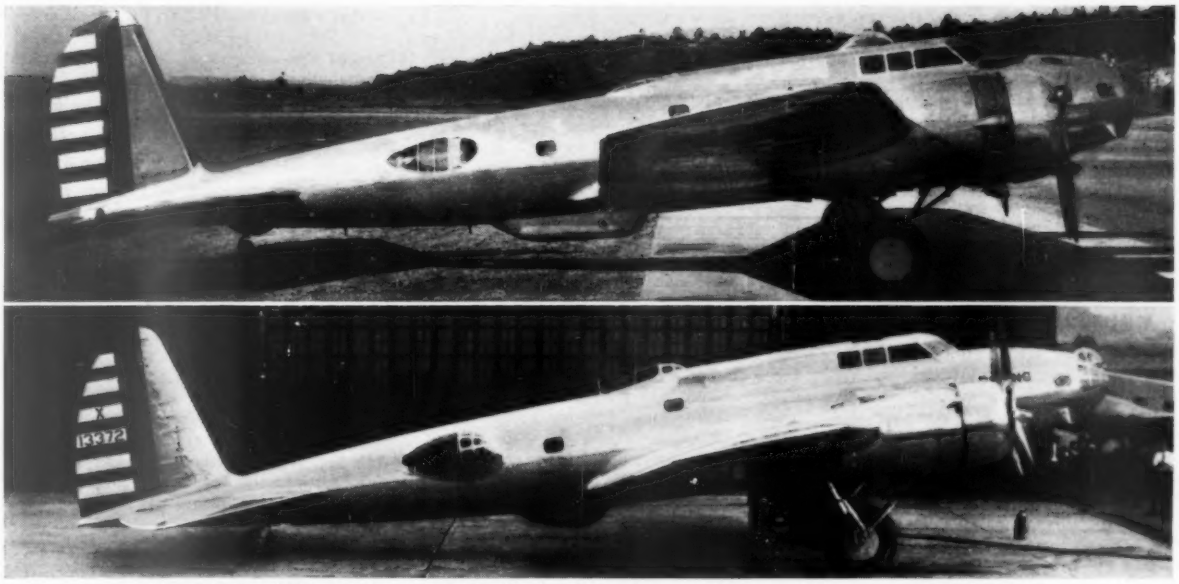
Above is one of several rebuilt Curtiss "Condors" soon to be delivered to Chinese. They were bought from South Americans.



New Howard DGA-125 trainer has 125 h.p. engine, cruises at 108 m.p.h. It is intended for CPTP secondary training program.

Douglas 8A-5 for Norwegian air force in Canada has seven guns, big bomb load and a top speed of 265 m.p.h.

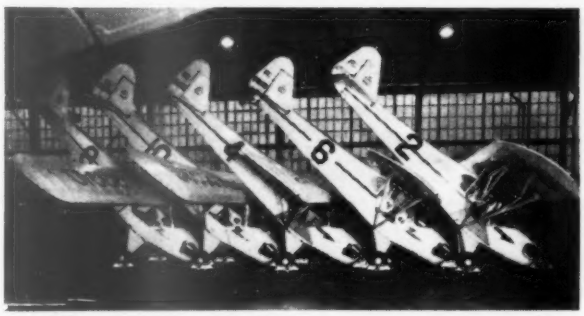




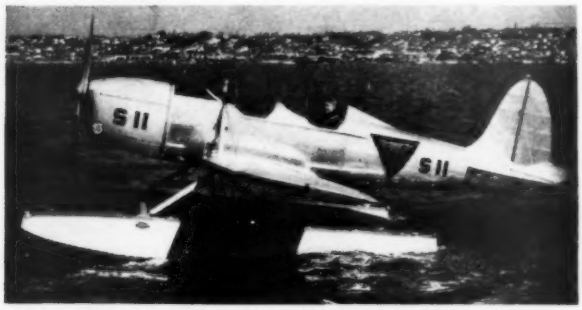
Latest Boeing "Flying Fortress" is B-17C (top). Note changes in turrets and shape over original B-17.

Gun above is a 37 mm. cannon mounted in nose of a Bell YFM-1A ("Airacuda"), is one of two on each ship. Note engine in rear.

New modification of Fairchild M-62 trainer is Warner-powered M-62B above. Engine and cockpit enclosure are late additions.



Lightplanes above are stacked to save space by using special equipment developed by a Lancaster, N. Y., accessories concern.



Ryan STM-2 above is first of order of naval training seaplanes for Netherlands East Indies government; 50 are contracted for.

At right is first picture of new Stinson O-49 observation plane. It has slots, flaps, carries no armament.

Airport in the Blue

(*Continued from page 21*)

Born in Bristol, Va., Roanoke has been home to Bob Dunahoe for the most of his 36 years. In 1929 the flying bug bit him and he proudly soloed on a Waco "9" from Roanoke's cow-pasture flying field. A period of traveling as a steam engineer followed, then came the overseeing of a restaurant-filling station chain; but behind it all was a steady background of flying.

"One summer," he reminisces, "Chris Carper and I—Chris is flying out of Kansas City now for TWA—buzzed about all over this section of the state in a J-2 *Cub* doing some free-lance aerial picture taking. We cleared $700 selling the pictures, but we quit. When stiff downdrafts kept on catching us over trees and houses at 150 feet, the chances were too good for making a one-way hop to the cemetery."

Although his job ties him down much of the time, Bob still flies for fun. He dropped his commercial license back to a private that there might be no suspicion that he, as manager, was doing any commercial flying. But many a passenger who is "afraid to fly" has been won over to his first hop and aviation by Bob's enthusiasm.

When the opening date of the fishing season is near, Dunahoe climbs into his red and white Aeronca *Chief* with that certain look on his face and heads for the hills. Local pilots grin knowingly. "There he goes—off to spot a good trout stream." For, next to flying, Bob loves game fishing. There's hardly a stream within a hundred-mile radius of Roanoke with which he isn't on familiar fly casting terms.

While Dunahoe was flying his way to a commercial license and instructor's rating, the Roanoke field was slipping from bad to terrible under its lease arrangement. The city fathers began looking about quietly for someone to manage their airport. Unknown to himself, Bob Dunahoe was recommended. He accepted on January 1, 1937, and began the toughest job yet to come his way.

If asked to explain the "how and why" of turning Roanoke's airport from a liability into an up-and-coming asset, Dunahoe can do it with a minimum of words. "There's one particular rule we've tried to follow here—" he explains, "the Golden Rule. In modern terms it means: 'Give the other fellow a break!' And that's the compass course for all our operations."

Every time a visiting plane glides in, one angle of Dunahoe's theory is illustrated. The prop has barely ceased turning over before Marvin Turner, assistant manager, is beside the ship.

"Howdy, sir. Glad to see you folks!"

Dunahoe or one of his staff stands ready to assist the occupants. He helps gather up the luggage and carry it to the office. The visitors are shown to the lunch room at the opposite end of the hangar. If transportation into Roanoke is desired, he'll either get it for them or have them taken in his own car.

Responsible solely to the city manager and auditor, Dunahoe has a free hand in forming and directing the field's operating policies. One of the first things he did upon taking over was to clamp down on an item which he considers fatal to any municipally operated airport—the granting of special privileges or monopolies.

"Who gets anything out of a closed field except the operator?" he demands. "Having leased the airport, naturally he isn't going to allow competition. So that automatically bars anyone who wishes to break into the commercial side of local aviation. Check up on leased airports and see how many privately owned planes are around—how much private flying goes on. Stack them against open fields where everybody has equal right and privileges. That's where you'll find flying on a boom.

"Competition is just as healthy in the business end of flying," he says, "as in any other game. The operator of a leased field can charge any price he chooses for flight instruction and plane rentals. Or he can raise the rates on hangar storage and other airport facilities until it would be foolish for a pilot to own a ship instead of renting the operator's planes."

"Don't hog all that oxygen, Moe . . ."

The prices charged for gas and hangar storage back up Dunahoe's declared intention of giving the local flying fraternity a break. Gasoline of 73 and 87 octane is sold. An 80 octane is available by combining the two. The 73 octane costs the plane owner 22½ cents per gallon; the 87 octane sells for 24 cents. Deducting the annual tax refund, the intrastate operator pays a net of 20½ and 22 cents per gallon; the interstate operator 17½ and 19 cents.

Hangar storage charges are in line with the fuel prices. Daily charges are $1 for 24 hours or fraction thereof. A private single-place plane costs its owner $10 per month; a two-place job, $12; three-place or more, $15. Planes used commercially are charged the same rates plus an extra $3 per month if used for student training. Passenger-hopping jobs pay an added tariff of $1 per seat, exclusive of the pilot's seat.

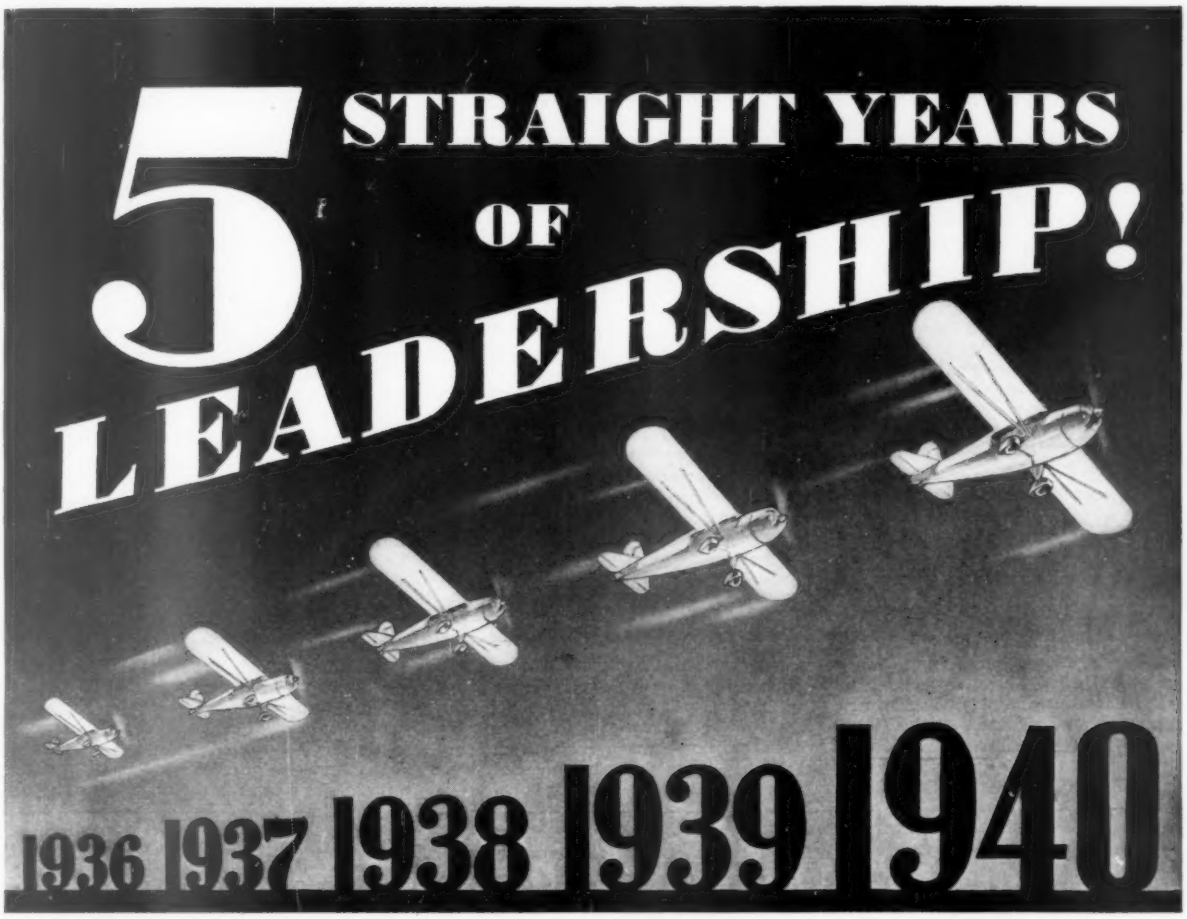
The airport manager's job at Roanoke never becomes monotonous, in spite of the ceaseless work which is a part of it. The first warmth of spring reminded Bob Dunahoe and his two-man staff that lightweight summer coveralls would be needed shortly to replace their heavy winter outfits. On the salaries paid them by the city—the checks of the manager, his assistant and helper total but $285 monthly—the staff felt that they couldn't afford to buy their own.

The city informed them that neither was it able to purchase the coveralls. But, in reply to Bob Dunahoe's query, any way he might arrange to procure the coveted coveralls would be satisfactory. During these negotiations a long overdue but unpainted wind tee made its appearance in the center of the field. Hardly a week later it shone forth in the freshly painted colors and trade-marked design of the Gulf Oil Company. Simultaneously Bob Dunahoe and his staff blossomed out in the finest set of summer coveralls worn at the airport in many a season.

Not all their problems permit such ingenious solution. When a private pilot, who had just come into possession of a Waco F-3, began hopping passengers commercially, Manager Dunahoe called the offender to his office and refreshed his memory on the C.A.R. The pilot took it in his stride—and the passenger-hauling went on unabated. Followed another reprimand from Dunahoe, coupled with the warning that continued violations would be reported to the CAA inspector. The Waco pilot insisted that in such an event the shortcomings of every other airman on the field should be brought to official attention. Shortly, an announcement signed by the airport manager appeared on the office bulletin board. There would be no more verbal warnings to violators of regulations. In a little black book Dunahoe jotted down infringements with names, dates and witnesses. To make certain that everybody would be in the same boat, he even broke a couple of minor points of the law and wrote them up on himself. When the inspector made his next visit a sizable number of local pilots attended—by request—an official dressing down session in the office. And, warned the inspector, if there were any more such reports, really drastic steps would be taken.

The episode has gone down in Roanoke airport history as the "black book incident," but it served its purpose. Illegal passenger-hopping ceased. And now, when local pilots overstep their bounds a bit, Bob Dunahoe drops a casual reference to the "black book" and the trouble smooths out.

The manager doesn't stop to think when asked to name his number one problem at



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present. "It's the public," he declares flatly. "On Sundays and holidays the crowds hit us in a blitzkrieg of curiosity. Every plane gets countless amateur inspections. That means holes punched in fabric, scarred paint and general tampering. We don't want to restrict visitors unnecessarily. But if they're given a run of the place, damage is sure to follow."

He points across the field. "See that crate?"

Near the boundary sits an old Stinson "U", tires missing and its three engines removed. "I've been thinking about covering up those nacelles and mounting dummy props. Then I'll hang a sign on the junk heap: 'PUNCH ALL THE HOLES IN THIS ANTIQUE YOU WANT. WRITE YOUR NAME ON IT, TEAR THE FABRIC, SPIN THE PROPS. CLIMB ALL OVER IT. IT'LL NEVER FLY AGAIN, ANYHOW. BUT PLEASE SPARE OUR OTHER SHIPS!'"

Since Manager Dunahoe put his open-field theories to work nearly four years ago, commercial operators have increased steadily and the business done by them—particularly in student training and plane rentals—is believed to exceed that of any other municipal airport in the state. The two major operators—Frantz Flying Service and College Air Express—operate a total of eight planes: two 65 h.p. Taylorcrafts, four Luscombes, one Aeronca *Chief* 65C and one 50 h.p. *Cub*. In addition to these are a number of single plane owners who operate their craft commercially. This group includes two Taylorcrafts, a J-5 *Cub Cruiser*, a Bird, two 40 h.p. *Cubs* and an Aeronca *Chief* 50. Of the 15 planes flown commercially, 13 are Class 1, only two Class 2S.

Healthy competition among the operators keeps instruction and rental rates at reasonable levels. Another effect has been to interest a surprising number of students in flight training. Instruction prices range from $8 per hour on the 40 h.p. *Cubs* to $9 on the 65 h.p. lightplanes. Rentals start at $4 per hour and run to $7.20 with the average figure set at $6.60 for Taylorcraft, Luscombe and Aeronca. The operators' explanation of that extra 60 cents on the hourly rate is that a penny a minute pays the plane's insurance.

Airmen at this field have their own organization—the Roanoke Pilots' Club. The only eligibility requirement is that a member must have soloed from Roanoke airport. High spot in the Club's activities is the annual pilots' picnic. Usually held on the farm of a genial fellow-pilot at Montvale, the hop up the valley from the airport takes but a few minutes. Swimming, softball and a picnic that includes everything from fried chicken straight through to numerous varieties of pie are always part of the program.

Famous White Sulphur, W. Va., with its airport on the edge of the polo field, isn't far away. Frequently a group of pilots will fly across the mountains, land and watch the matches from their planes. Now and then there's a breakfast flight. Instead of the conventional thing, however, necessary paraphernalia is stored on board the planes, the pilots fly to some river-bank cow pasture, catch a string of fish—if they're lucky—and cook their own breakfasts.

Roanoke airport is operating out of the red now, but it took three years of unceasing effort on manager Dunahoe's part. For nearly two years prior to his taking over the field for the city, American Airlines gave Roanoke scheduled service. Then the line retired its Stinson "A's" from service and discontinued the Roanoke stop until such time as the field was made suitable for day and night operation of their bigger and heavier DC-3's.

With a definite goal in mind now, Dunahoe and his helpers labored to consolidate sentiment toward securing a municipal appropriation for development of the field. Roanoke pilots appeared en masse before the city council. Finally the proposition was submitted to the public in the form of a vote on a municipal bond issue. The taxpayers snowed it under with a plurality of negative votes. Dunahoe took it with a grin, but he wasn't through. His methods had demonstrated what the airport was capable of. What couldn't be secured in a lump might be gotten piece meal. Of the airport's 300 acres, only 120 had been developed for actual use.

He worked out the order in which improvements should be made, obtained architects' designs and cost estimates of the new buildings so sharply needed. Then the struggle began again. There were more sessions with city council and civic bodies which might back an airport improvement project. Trips to Washington followed, with the purpose of interesting Federal au-

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thorities in spending national funds on the field. The Virginia Division of Aeronautics began to hear from him. He went to Richmond, threatened to camp on the division's doorstep and present a bill for board and lodging while he did it unless Roanoke's share of the state airport improvement fund was immediately forthcoming. He won and shortly work was begun on an additional concrete apron.

In self defense the city handed over $7,000 for a second hangar. Planes owned at the airport had multiplied until it was necessary either to erect the additional building or leave part of the craft outside. Then when public inertia became too weighty even for the dogged work of Dunahoe and his helpers to force into motion, Nazi General Goering's air force began its European parade. This country looked hastily to its air defenses. Dunahoe saw his chance.

A. H. Wessell, CAA regional airport engineer, was called to Roanoke. He helped to formulate recommendations for revamping the field. Dunahoe and his cohorts lined up civic organizations and public spirit.

On Virginia Congressman Woodrum's invitation, an Army general staff officer was asked to Roanoke for an official look-around. His reaction was that the airport is a "natural" for military defense purposes and recommended immediate action. With Dunahoe working day and night and keeping his fingers crossed, the WPA application was submitted directly to Richmond. The Division of Aeronautics okayed it swiftly and the papers were hustled on to Washington. Recently Roanoke newspapers headlined:

"ROANOKE AIRPORT MADE DEFENSE PROJECT. War Department and WPA Approve Plans at Cost of $313,315. Work Slated for Immediate Start."

Bob Dunahoe takes the triumph gravely. "You see," he explains, "the field set a precedent in 1939 by paying a net operating profit. But with grading and surfacing going on and new drainage lines being installed, we'll be lucky if flight operations aren't curtailed. And that might wreck our hopes of ending the year out of the red again. However, by July 1, 1941—" grinning, he raps on his wooden desk, "we're counting on having a field worthy of being Roanoke Municipal Airport."

END

Flying Funnyman

(*Continued from page* 15)

producer of radio shows, a writer of motion pictures. Some people are aware that he's a pretty good magician. He's linked with the creation of Charlie McCarthy and Mortimer Snerd, his radio cronies. He's listed in the public mind as an ex-vaudevillian. And a dozen other things.

But few know about the ideas he has on aviation. You'd be surprised to know, for instance, that when you fly across country in an airliner the pilot at the controls is liable to be there because Edgar Bergen, the funny guy with the dummy, had an idea.

The idea was the establishment of the Edgar Bergen Foundation. This personally owned and operated foundation was established because Bergen saw a need. Playing around with aviation as he has for the past 10 years, he was in a position to realize that there were a lot of fellows with about a thousand hours of contact flying on their logs. And that there were a lot of airlines who'd like to have instrument flyers—good men.

"But," says Bergen, "I discovered that these lads who had so much time couldn't qualify for airline work because they didn't have enough money to take an instrument course."

An instrument course costs from $300 to $400 if you do it right. Some of the flyers couldn't save enough money to take courses because they didn't make enough. Some had heavy financial responsibilities—children and other dependents. But Bergen thought they were worthy of a break. So he discussed the matter with TWA and United Airlines officials.

"I'll send these pilots to you," he explained. "You give them a good examination. Study them. Find out their backgrounds, everything you can about them. And, if you feel that they'd make good pilots if they had instrument ratings, let me know."

Several of the men had what it took to jockey the big planes around. The officials reported favorably. So last year Bergen very quietly and without ostentation set up his foundation. He gave $10,000 to it. He told the pilots who could qualify to go see Joe Plosser, who operates a flying school at Grand Central, learn what they had to learn and draw on the foundation for funds.

"The way you'll pay me back," Bergen said, "is to get a job and return the money to the foundation. You'll pay 10 per cent of your salary until you've met your obligation. There'll be no interest charges, of course."

This year Bergen added to his original "investment" in the foundation. So far, four of the pilots have been placed with TWA and United Air Lines. Seven more are in training, and a number of others are under investigation. Only one pilot has failed to follow through—certainly through no fault of his own, however. He was called to serve with the National Guard. At present Bergen is planning to enlarge the scope of his plan, taking in other flying schools, so that pilots not based in Los Angeles can take advantage of the loan system.

The foundation, incidentally, also functions in another field. If a trained nurse wants to specialize, hasn't the immediate funds and proves that she's capable and sincere, she can borrow from the foundation and pay back on the same basis. At present, Bergen is working with six hospitals on this.

Bergen has other ideas.

In line with what people don't know about Bergen is his mechanical ability, as well as his interest in things mechanical. His first triumphs in inventing things occurred in his early teens. When he was 13 and was living in Michigan, he became chemically minded and constructed a still which distilled essence of peppermint. It worked very well and caused a lot of comment around Deca-

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tur. Flushed with the success of this venture, he harnessed a small waterfall on his uncle's property, installed a generator and developed enough "juice" to run an electric lighting system. And, when he was in the seventh grade, he was known as the town's official photographer. He photographed, developed, printed—and his work was good.

What, with experimenting with magic, he was a busy young man. And this leads us up to another one of today's ideas. Bergen—by this time we might as well start calling him Edgar, which makes us fresher than Charlie McCarthy, who sticks to his last name—is a member of the International Alliance of Motion Picture photographers. In his Beverly Hills home he carries on experiments with cameras, sound recording, lighting and projection.

"I think," he says, now that he is in the throes of preparing for an examination in meteorology and navigation, "that when I get time I'll get busy and film cloud formations. Then they can be projected on screens for ground classes. A narrator will explain the various clouds, how they are formed and students will have an easier time remembering them and more fun learning about them than they would in an ordinary ground class."

After thinking the matter over, Edgar went farther.

"In fact," he added, "it would be a swell idea to illustrate everything in connection with taking a flying course. Right up to getting a private license. It would be a graphic way to show young men how to take off and land an airplane, correct for ground drift; how airplanes respect rights of way and various other rules and regulations of the CAA; the function of various navigational instruments. A fellow could do a lot of good with a film like that. It would make learning to fly a lot faster."

He's quite apt to do it. It's an idea. And another idea which he has for making flying easier is to make rhymes. He'd like to see a lot of pointed limericks written—they're so easy to remember—which a fellow could learn. A development of the "east is least and west is best" idea. He'd be willing, he says, to offer prizes for the best limericks. He'd like to tie up with some publication on that one. Personally, after trying to learn a prose Beaufort scale of wind velocities and tearing my hair out remembering that east is odd and west is even when selecting instrument cruising altitudes, I could go for some verse myself. I'd like a rhyme that would recall the 10 kinds of clouds and name the few odds and ends that affect climate.

Bergen says he's always been interested in flying. But, as in many other cases, one can trace his liking back to that first ride given in the ramshackle crate of a barnstormer. He remembers that the flight was given him somewhere in Kentucky, that the thrill stuck and that he's wanted to learn to fly ever since.

His flying career has been strictly "stop and go." He didn't always have Charlie McCarthy, which is synonymous with saying that he wasn't always flush in those days before Charlie became a mechanical adventure, let alone a radio, screen and theatrical success. Since he got his first instruction in an Eaglerock in 1932 in Kansas City, his life has been one attempt after another to find time, money and the confidence to fly. He got two hours in Kansas City and doesn't recall the name of his instructor. Eight years ago, in Toledo, he took time off from a vaudeville engagement to have another fling at clouds—and caught an adventure. The top blew off a cylinder and the ship coasted downhill to the airport.

"I got an idea then," he says, "that flying might not be too practical. In fact, it might not be quite safe."

Then, three years ago, he met Tex Rankin. Rankin gave him six of the best hours he'd ever had, he says, and "sold" him right back into trying. But Tex went away to do a series of flying exhibitions and Edgar drew another vacation from cloud busting.

His next session was with Al Lary. At that time Lary had only an open plane, it was winter, and Bergen's enthusiasm wasn't the only thing that was chilled. Came spring and Bergen took three or four hours with Cecil Smallwood at Clover Field. He topped that with time in a Stinson "105" with Al Lary again and this time flying stuck.

"I soloed," he says, "on May 31st of this year. I don't believe that I ever spent so much time learning to do anything as I did learning to fly. There were times when I was sure that I'd never make the grade—that aviators must be supermen—and that if I could ever get two wheels and the tailskid on the ground all at the same time it would be a miracle."

The Stinson was purchased on July 27 of this year. Bergen and Lary went back for the yellow and black plane. Lary, who has a habit of dozing off every now and then and letting his student do the work, handled the wheel for just two hours. Bergen's progress across country was heralded by the press, and his biggest kick came at Memphis when the control tower operator said:

"Come on in, Mr. Bergen."

He and Lary dodged a thunderstorm, Lary taking over while Bergen took pictures of the phenomenon. Aside from this meteorological display, the trip was quite without incident as the plane visited Little Rock, Fort Worth, Dallas, El Paso, Tucson and Phoenix.

"I'd like to do it all over again," he says. And he probably will when he gets time. He's slightly on the busy side at the moment. Aside from getting better acquainted with the Stinson every chance he gets he prepares his Chase and Sanborn program during the week, is making a one-reel color picture and is making plans for a feature picture which he will produce in his own laboratory, is working on a story which he expects to make when he finds a producer and a director and he's working on slot machine movies. The one-reeler will introduce a couple of new characters—hens.

He's very modest about his flying accomplishments. You get the idea that

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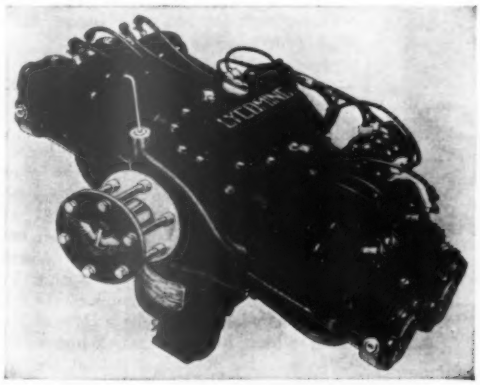

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he's snickering up his sleeve at himself. One of his stories is about his recent flight on a very hazy day from Grand Central to Alhambra. The two fields are probably 10 miles apart.

"I decided to do a little dead reckoning," he says, "so I worked out my problem. Then, after due deliberation I took off. I flew carefully above the haze, let myself down and there was the airport directly beneath me. Only it wasn't Alhambra—it was Montebello." Which is some distance away and in a different direction. And then there's the story about his 15-minute bit of flying from Grand Central to Mines Field.

"My instructor showed me how to work out a compass course," he explains, "so I got my maps and figured it all out carefully. I got into the ship, kept my head down low so I couldn't see where I was and, in 15 minutes, found myself directly over Mines. But I think I must've cheated a little bit, because I forgot, in figuring my course, to subtract 15° of variation."

His first cross-country adventure, strictly solo, is interesting, too. He decided to fly to a place above Moorpark, where he'd been deer hunting. He looked the country over, decided to land in a wheat field and did. A farmer came out, found that he was a lost aviator, fed him milk and pie—and then recognized him.

"The neighbors came in," he says, "and we had a swell time. I never tasted better pie."

Does Charlie fly with Bergen? Of course. As a passenger.

"But he'll never learn to fly, the wooden head," Bergen says. "Look what a time *I* had."

Charlie, however, is doing all right on his own behalf. Not long ago the Air Corps detachment at March Field summoned Bergen and Charlie, gave them special permission to land in the Stinson and made Charlie a master sergeant mechanic. And they gave Mortimer Snerd a degree. G.B.—for Grease Ball.

"Flying," Bergen concludes, "is the greatest form of transportation, whether you go in your own lightplane or on the airlines. I've another idea. Maybe it's out of line and it's not my place to say so.

"But I'll say it. If I was a railroad president today I'd really go to town with my trains. I'd give my patrons motion pictures, telephone communication and stock market reports along with a lot of other service. If something isn't done, a lot of business is going to change hands—even more than has changed already.

"Aviation is full of new ideas and any form of transportation which is going to keep up with it must have youth, must not be hampered by tradition and set rules. I tell you, the railroads will have to start having ideas."

END

Three Dimension War

(*Continued from page 34*)

not constitute airpower. The elements of airpower are such that one must have the air force—and all that goes to comprise it—to build from. The first essential is *reserve strength* in planes, pilots and other personnel. Then there is the consideration of *quality;* a second-best warplane is, to say the least, at a disadvantage. Production, which is to be evaluated in terms of both rate and capacity, of planes, engines, accessories and armament, is an essential. These factors are largely dependent upon the degree of *industrial mobilization* that may be attained and the *morale* in, and out of the air arm. This is airpower, the greatest of modern weapons.

But like all weapons, it has certain limitations—few it is true. Without cognizance of these limitations we should not have a true picture of airpower. First and greatest is the "time of flight." Warplanes must land after a few hours for fuel and ammunition; planes on the ground are the most useless of weapons. This brings about another limitation: the inability to sustain operations, which, in turn, results in great loss of time. Another limitation lies in the extreme vulnerability of aircraft, as compared with other weapons such as the tank and warship. No other war instrument can be so easily rendered *hors de combat.* Through the near perfection of the parachute troops' tactics and the employment of air-borne infantry, the high commands have partially overcome what was once a definite limitation—the inability of airpower to capture and occupy territory.

These shortcomings do not alter the fact that airpower is the greatest military agency man has as yet devised to obliterate himself. This is particularly true in light of the fact that all air operations are fundamentally offensive. Aviation may be included in defensive strategy—as is the case in the Battle of Britain—but pursuit planes pursue and shoot at enemy craft, bombers bomb, and attack ships attack. An interceptor cannot "defend" an area against assault except by fighting that bomber and destroying it.

More than 20 years ago, our late esteemed General William Mitchell—as you well know if you've been reading Flying and Popular Aviation lately—visualized the advent of airpower. Italy's General Guilio Douhet propounded the first official doctrine for aerial warfare. He was a little bit wrong—but only a little. His aerialism has yet to be accepted, even with modification. Every one of Billy Mitchell's convictions—"prophesies" does not seem to be the correct word—have been demonstrated in a manner too conclusive for question. Who, we wonder, will become the Alfred Thayer Mahan of airpower?

END

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(*Continued from page 20*)

received his grammar school education. After graduating from Culver Military Academy, Culver, Ind., he studied aeronautics at the Renssaelaer Polytechnic Institute at Troy, N. Y. It was at Troy in 1937 that Norton learned to fly. The following year he bought a *Ranger* Fairchild which he keeps at Ashburn field, Chicago. He joined Arens at the suggestion of his father, R. H. Norton, president of the wealthy Acme Steel Company. The elder Norton, P. W. Grassell and M. W. Van Arsdale are directors of Arens Controls, Inc. Grassell is president and Van Arsdale vice president of the Wilson Steel and Wire Company, Chicago.

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Proficient Professor

(*Continued from page 39*)

over 100 students, from as far away as Florida. It has a faculty of 10 instructors. Its work is carried on in a building constructed in 1923 by the Guggenheim Foundation.

The Professor is one of many men who have made the lumber and shipping metropolis of Seattle a major center of aviation. The background of this persistent, patient man of ideas is a startling design of adventure.

Kurt Friedrich Johann Kirsten was born in Grossenhain, Germany, in 1885. As a boy of 11, he had decided he would become an engineer. But a careless government official lost his application for a scholarship at the Emperor's Academy of Marine Engineering in Kiel. When he was 16, the disappointed youth signed up on the *Elfrieda*, a three-masted full-rigger out of Hamburg.

"I thought it would be good experience," the gray-haired professor now chuckles. He had always loved the sea and some day, not too far off, he would settle down and become a typical German citizen. But it was nine months before the vessel reached Tacoma, Wash., in the spring of 1902. In that space of time, the slender German youth encountered most, if not all, of the strange and barbaric seafaring traditions of his time. And he never returned to his native land.

When the *Elfrieda* crossed the Equator, for instance, calloused shipmates doused the newcomer in a barrel of tar. They shaved him with a two-foot wooden razor. He laughed once at a shipmate's superstitious gesture; the irate sailor turned quickly and a knife hurtled past the astonished youth. Once Kirsten removed his oilskins less than three days after a storm. A blacksmith heaved an eight-pound hammer at him because the apprentice—of all things!—didn't know that such action only invited another storm.

That wasn't all. The rusty, black-hulled vessel was becalmed on glassy south Atlantic seas, then blown into the Antarctic ocean, hundreds of miles south of Cape Horn. Facing starvation and death by freezing, the boy gained maturity. It is probable that much of his resourcefulness and practical outlook dates from that harrowing voyage. Not to mention a working background of aerodynamics.

The apprentice jumped ship in Tacoma. Penniless and discouraged, he sought security and an education. He met a German immigrant-hop rancher, Henry Frey, and accepted an offer of a farm job at $10 a month. Arriving at his new home, he saw 10-year-old Agatha Helen Frey swinging on the gate. Many years later he married the farmer's daughter.

Subsequently the immigrant boy worked his way through the University of Washington, obtaining his bachelor of science degree in 1909 and, in 1914, a graduate degree in electrical engineering. By now his home was in the green country of the great Pacific northwest and he joined the University of Washington faculty in 1915 as assistant professor in the engineering school. His first patent was filed the next year, on a stump-pulling device still "unduplicated," according to the professor.

Like most engineering students of that time, young Kirsten's studies lapped over into aeronautics. But it was not until 1920 that the University of Washington organized a department of aeronautical science. In the intervening years the youthful professor's assistant combed all available data on the subject and for a time, in 1917, he was engaged as a research worker at the Boeing Aircraft Company. After the department of aeronautical science was organized, Kirsten devoted his full energies to the study of aviation and in 1922 he received his full professorship. Today he is director of research at the department and has a modest office and basement laboratories in Guggenheim Hall. His earlier training in engineering is still reflected, however, by his membership in the American Society of Electrical Engineers and in the American Society of Mechanical Engineers.

A few paragraphs back we mentioned the cycloidal propeller and hinted briefly at its importance in the career of this German-born scientist. Probably you will hear more of it in the near future. The device is drawing a second look from those who once shelved it in such uncomplimentary fashion. In July, 1939, Col. Charles A. Lindbergh flew to Seattle. He met the professor and they talked over the cycloidal propeller. This, apparently, was the forerunner of renewed interest in the invention. If the Government takes over the plans and spends up to $250,000 on development of his idea (including a full-scale working model) Kirsten says we have a very good chance of obtaining an aerial weapon more lethal than anything on the battlefields of Europe today.

Meantime, with wind tunnel tests and some mathematical calculations, the professor and his aides are convinced that a plane using his propeller will be greatly superior in speed and virtually noiseless and spin-proof in flight. They reason that present aircraft propellers lose efficiency when the blades revolve at a speed exceeding that of sound—720 m.p.h. From the military standpoint alone, this factor has a deteriorating performance effect on the range, speed and ammunition capacity of all warplanes—from the fast, light pursuit ship to the *Flying Fortress* manufactured in Seattle by Boeing.

Attacking the problem of airscrew efficiency, Kirsten studied the birds in flight. The rotating motion of their wings gave him the clue as follows: Why not obtain propulsion from rotating blades attached to the sides of the body. Properly synchronized, he knew, such a device would furnish the necessary lift and the increased number of blades (three or six to each side) would distribute the burden now placed on one to four propellers. The blades are of tear-drop contour with the leading edges rounded. They are feathered to catch the lift on their downward arc, to propell on the upper arc. His present model, undergoing alterations, is equipped with six blades on each side. A centrifugal wire is fastened to the blade tips, although the inventor hopes to dispense with these at a later date. Finally, two smaller cycloidal propellers act as stabilizers. The fuselage and body remain largely unchanged from present design.

Some have called the Kirsten plane an "aerial sidewheeler," which isn't an accurate description in all respects. Admittedly the visual resemblance is there. By distributing the burden of airscrew performance, the inventor has calculated that each blade will require fewer revolutions per minute, to an extent not yet fully determined. By pushing up the limits on speed, he foresees a better-balanced military plane. Finally, aircraft of this type will take off, fly and land almost noiselessly and will be able to reduce its landing speed to 30 m.p.h. or less. Such a craft would be a neat finishing touch on the Nazi-forged weapon of parachute troops.

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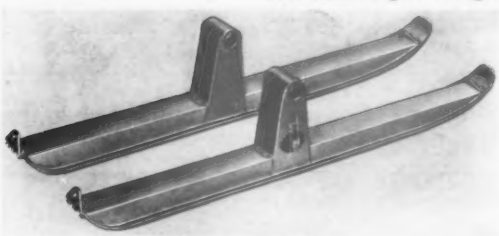

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That's cycloidal propulsion. From the production end of aviation, two reactions can be foreseen. Obviously, successful adaptation of the cycloidal propeller to aircraft will produce an upheaval in an industry already harassed by constantly-fluid standards of performance and design. On the other hand, the inventor believes this plane will be cheaper and easier to produce, tending to encourage a standard design in preference to multiple-engined planes. It would have no material effect, Kirsten believes, on present engine types and their continued use. Nor will it place emphasis on any particular type of engine.

One aircraft manufacturer, William E. Boeing of Seattle, invested $280,000 in Kirsten's research between 1921 and 1925. The aviation industrialist gave up in despair when our military and navel authorities were deaf to his pleas for a tryout.

Although its aerial adaptation has yet to bear fruit, the cycloidal propeller has been installed on marine vessels of every major maritime nation except—paradoxically—the United States. Kirsten estimates that 200 ships, ranging in size to the German passenger liner *Helgoland*, are using the device. Sketchy reports from Europe indicate that German torpedo boats may be equipped with this American invention. Significantly enough, Germany has given especially close attention to the cycloidal propeller and German scientists also are working on the invention's adaptation to aerial craft. So far they have not succeeded.

The Seattle inventor shows correspondence with the German firm of Voith-Schneider, largest manufacturer of cycloidal propellers, relative to establishing a branch factory in Seattle with access to America's raw materials. Then war broke out and the plan fell through. It is only fair to add here that it is no fault of Kirsten that development of the cycloidal propeller fell into foreign hands. He was unable financially to maintain his patents abroad.

The professor had occasion several years ago to turn his attention to propeller problems of another nature. When the University of Washington's wind tunnel was under construction, he developed a blade of symmetrical cross-section. Where propeller blades now have one flat side, the product of his study was a double-camber blade. These were mounted seven to each of two wind tunnel propellers, where they generate a maximum air speed of 250 m.p.h.

Since 1916, Kirsten has filed 70 patents. Most of them are not significant to the general public. Some, however, are newsworthy as witness his recent disclosure of his blanketlessbed, wherein a rheostat at the head of the bed controls air currents to desire and specifications. Newsmen were immensely intrigued by this device and its appearance brought requests for information from as far away as New York.

Farmers also know the professor. Apple producers in the famed Wenatchee and Yakima regions of central Washington use his "death ray" to combat the destructive codling moth. Super-powered lamps, one farmer reported, attracted and killed 450 moths in one night.

Kirsten is of wiry and athletic build but he doesn't fly; use of his left hand was permanently impaired in an explosion during some laboratory experiments several years ago. The combination of professorial and creative routine keeps him at his office many hours past dinner, his wife testifies. Yet he is sociable and has a reticent pride in his two children—Eugene, a college student with no marked bent for his father's work and Dorothea, who married a chemist to the obvious satisfaction of her father.

Whenever Professor Kirsten is tempted to relax, he reminds himself of his unfulfilled dreams for the cycloidal propeller.

"There's always something to be done," he observes. "We have a whole field spread before us—practically undeveloped as yet. Our laboratories, college and industrial, are equipped in facilities and manpower to show what can really be done in aviation."

END

WPA Accomplishments

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Japan

(*Continued from page 14*)

The 97 series of planes is the first of modern construction. The heavy bomber is a four-motored job whose top speed is about 260 m.p.h. The maximum bomb load, however, is only 3,000 pounds; maximum range (maximum bomb load cannot be carried at maximum range) is 2,200 miles. Type 97 pursuit and observation ships approach 300 m.p.h. These planes still are standard.

A later twin-engined bomber, Type 98, is the Fiat BR-20M, built under license. The Japanese air force also has 80 Italian-built Fiats purchased in 1938. The Italian-built BR-20M is a pretty good bomber for a 1938 model: 256 m.p.h. top speed on two 1,000 h.p. Fiat radials. Gross weight of the plane is just over 11 tons. It is not believed, however, that the Japanese version is quite so fast or efficient, partly because Japanese-built engines do not deliver the same power as the Italian.

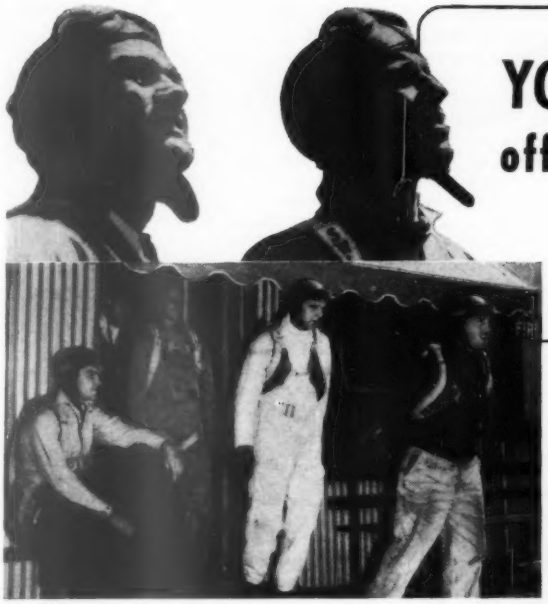
Japan's aircraft factories, following several years of intensive effort on the part of the government to encourage their development, now are in a position to produce about 2,500 planes a year of all types—if they can get the materials. Raw materials are a difficult problem. Neither Japan nor China, for example, produces much bauxite, the ore from which aluminum is extracted. In the past, Tokyo has met a considerable part of its aluminum requirements by purchases in the United States, but the urgent need for aluminum in this country and the possibility of an embargo make the U. S. an unreliable source for Japan.

The Japanese engine industry has yet to pass the thousand-horsepower stage of development. The 2,500 planes a year is somewhat more than is necessary to maintain the air force at its present strength.

Another indication of the poor quality of Nippon's planes is the fact that about one-third of the planes in China wear out each year and one-fourth in Japan. This does *not* include losses inflicted by the small Chinese air force.

It may well be asked why Japanese military planes are so few and so poor in comparison with other powers. An important reason is the fact that civil aviation is in an extraordinarily low state of development. In other countries, notably our own, when military air appropriations were at an ebb, an aircraft industry based on transport and charter services and private flying was able to lay the groundwork for much of the later expansion in the military field.

Japan operates a considerable number of airlines now, but they are a recent growth and are not heavily traveled. When I was in the Far East five years ago there was only one Japanese line operating within the mainland of Asia—the Japan Air Transport Company, which flew a couple of services in Manchuria. I trusted my life to its moth-eaten planes more than once; now that I look back on it, it gives me the shivers. When I look back, I recall that the American-operated outfit in China, the China National



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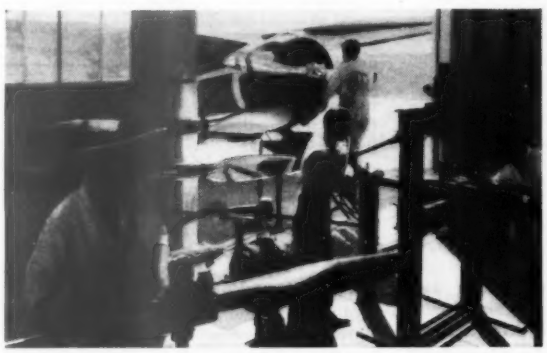

Also, for every man in the air, approximately 8 other men are pursuing active, useful, remunerative aeronautical careers on the ground—Mechanics, Instrument Specialists, Radio Specialists, Meteorologists, Dispatchers, Traffic and Passenger Men, etc., etc. And Boeing School-trained men are making good in all of these careers today in 48 different aviation organizations.

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Aviation Company, didn't have any too modern equipment at that time, except for a few Douglas *Dolphins*. But CNAC's planes were positively 25th century compared with those flown by Japan Air Transport.

Civilian flying did not develop in Japan largely, I think, because of the poverty of the country's people and because Japan is small. Another factor is that for years civil aviation has been under the thumb of the Ministry of Communications. The Communications Ministry runs the railroads along with the wire services and has never been particularly interested in the air. In Manchuria the giant South Manchuria Railway Company, which runs everything from half a dozen railroads to the dope traffic and red light districts, doesn't care about airplanes either.

But there is an even more compelling series of reasons for the current state of affairs. It must be remembered that Japan arrived late on the modern industrial scene. The experience of the Japanese people with mechanical gadgets is definitely limited. They have not yet gotten much beyond merely imitating what others have done. At that they are the world's finest, but imitativeness is little help in aeronautics. In the first place, aeronautical developments are more closely guarded by the major powers than are any others. Anything the Japanese obtain via the imitation route is bound to be three years old. Which is not extremely satisfactory at a time when every fighter plane designed is between 10 to 50 m.p.h. faster than its predecessor.

In the second place, planes being the most complicated and highly developed type of machinery in existence, a certain amount of native ingenuity is needed to make them work, even after you have been presented with the blueprints. And third, the Japanese system of small factories employing only a few semi-skilled workers—which system dominates Japanese industry—is not well adapted to the high degree of precision required in planes.

Some day, perhaps, the Japanese will have accumulated enough experience in a mechanical way to catch up, but that day will not come soon. One of the factors holding up its arrival is the educational system in Japan, which turns out a nation of blind patriots but gives only limited schooling in the mechanical arts. The general level of education in Japan is low. It takes a good educational system to turn out a nation of mechanics—and a nation of mechanics to run an air industry and air force. The Japanese' blind patriotism is undoubtedly pleasing to Japan's rulers. But it doesn't cut any ice with a 1,000 h.p. motor. Motors just don't understand noble sentiments.

It is no surprise, therefore, to learn that Japan's five aeronautical research institutes—the institute at Tokyo University, the Army's institute, the Navy's aeronautical arsenal, the experimental laboratory of the Communications Ministry and the Central Aeronautical Research Institute—are not making effective progress in research. They are not in the same class as America's NACA Langley Memorial Laboratory, or England's Farnborough. Their equipment is deficient. Such modern apparatus as supersonic speed tunnels, refrigerated tunnels and variable density tunnels is unknown.

There remains one question: what of the Japanese ability to fly? Is it any greater than the Japanese ability to build planes? The answer is probably yes, although five years ago Japanese airmanship was extremely poor. I wasn't there at the time, but old hands in the Far East tell a story illustrating this. It is about a German pilot who used to be with CNAC, and an encounter he had with the Japanese.

It seems he was nominated by the German embassy in Tokyo as a special observer for some special piece of business that was to be shown. The night he arrived in Tokyo he drank himself too deep of Japanese beer, which happens to be quite strong. Somewhat in his cups, he boasted that he could knock down the 10 best Japanese pilots one after the other in a single afternoon of dogfights—with cameras, not guns, of course. He had not laid a hand to a fighting plane since the World War, but he was quite sure he could do it. He did—in less than two hours. He didn't need the whole afternoon.

The Japanese have come a long way since then, particularly in bombardment and observation operations, through their practice in the China war. They now are quite proficient in these operations—although how they would perform against real opposition is not known. The relatively high toll taken by the few Chinese planes indicates, not too well. In loyalty, courage and readiness to follow orders, the Japanese pilot is second to no one, however. So far, the Japanese have shown no understanding of the tactics of massed aerial warfare on the World War II model.

In summary, the Japanese air force can be described as the sixth in the world in numbers and quality, as adequate to the job it has so far had to do. But it would not be adequate in the event of an encounter with either possible major opponent, the U.S.A. or the U.S.S.R., unless—in the case of the U. S. S. R.—simultaneous war in the west drained too many planes from Siberia.

END

Patriarch

(*Continued from page* 43)

had learned that an abrupt nose dive with accelerated speed would take a plane out of the deadly right spiral."

A grizzled veteran of 21, he continued to train pilots for military duty until peace was declared and he turned his attention to a new novelty that was springing up between Washington, D. C., and New York. The Government was experimenting with air mail and wanted experienced pilots. Lee wired an application for the job and was accepted by return telegraph.

That experiment in a wartime Jenny became his life job and he's still at it, only now at the controls of a passenger airliner with its huge cargo of express as well as air mail.

"Aviation history calls the establishment of our New York-Washington route on May 15, 1918, the birth of commercial aviation in the United States. If that's so, then I am the only one of the four original air mail pilots of that year who is still flying the mail. In comparison with the instruments we have today the collection of inefficient gadgets we had then was pathetic. We had an altimeter of sorts and an air speed indicator that might or might not work. The less said about the compasses the better."

The pilots of early air mail days were a harum scarum lot who hated discipline and who, knowing that a pilot's life was only a matter of months, lived accordingly. There was no system of licensing and a man's application for an aviator's job was recommendation enough that he know how to fly.

"They tell the tale," said Lee, "of men who would come up to an experienced pilot and ask:

"Say buddy, tell me how to fly one of these things, will you? I just got a job to go to work on the air mail."

Short, stocky, physically hard and still boyishly enthusiastic over flying, Lee doesn't give to reminiscing and many of the colorful escapades of his flying youth are forgotten forever. Reserved and confident, he looks more like an alert business executive than a pioneer.

He was involved in an early pilots' strike that resulted in the adoption of many safety measures that are still in force. Under bureaucratic management, the Post Office Department was guilty of many mistakes and frequently ordered the pilots to take off in the face of weather that practically guaranteed disaster. Although they had more than their share of bravery these men were beginning to rebel at taking useless

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chances. They were paving the way for the safe and cautious commercial aviation of 1940. Faced with the beggar's choice of taking a desperate chance or losing their jobs they sometimes side-stepped the issue by purposely crippling their planes so that they could not be forced to take off It wasn't cowardice, it was simply self-preservation in the face of orders from above from men who had no knowledge of weather, frail planes and inadequate instruments.

One day at Belmont Field when the gale was approaching hurricane magnitude an excellent and brave pilot, Leon Smith, was ordered up. Scorning subterfuge, he declared no man could live aloft in such winds and flatly refused to leave the ground. Lee, next in turn, was ordered out but refused, saying: "If that gale is too bad for Smith, it's too bad for me."

Demands came from Washington to fire Smith and Lee. All of the remaining pilots walked out in protest and for three days no mail was flown. As spokesman for his fellow aviators, Lee was called to Washington for a conference and out of that meeting came a new understanding on the part of both the air mail officials and the men who flew the mail. Assistant Postmaster-General Otto Praeger, who well may go down in history as the father of the air mail, spoke bluntly.

"I've got to fight a Congress who think air mail is nonsense and who won't appropriate money. I've got to fight an apathetic public who won't use the air mail. And now if I've got to fight you men, too, there just won't be any air mail."

"When I carried that message back to the pilots we all began to get a new understanding of the magnitude of our jobs," said Lee. "I think for the first time we took a serious view of our responsibility for building up public confidence in the air mail and the future of air transportation."

The Post Office Department, too, saw the pilots' point of view and allowed them more individual choice as to whether a flight should be attempted or not.

Lee was recognized as one of the service's top pilot so, in August, 1921, when the Post Office Department decided to start an air mail service between Chicago and St. Louis, he was selected to pilot the inaugural flight. He also flew the inaugural mail flight from Minneapolis to Chicago in November the same year. Because of lack of funds both of these routes subsequently were dropped and all attention centered on the transcontinental route between New York and San Francisco. Lee was transferred to New York to fly the New York-Cleveland sector. In the winter of 1923, however, after the night air mail had been established between Chicago and Cheyenne, Lee was transferred to the Chicago-Omaha run. The Post Office Department wanted its best pilots on the night sections.

In that winter, Lee made the headlines in the papers throughout the country for his rescue of a band of lumberjacks who were marooned and starving on a remote South Fox Island, 23 miles from mainland in northern Lake Michigan.

In 1927 he became a pilot for United Air Lines when that company took over the air mail and established regular coast-to-coast service. At present he flies between Los Angeles and San Francisco.

"In the early days we studied land marks," said Lee. "Now we keep abreast of new developments by studying radio, flying procedures, meterology, engineering, mechanics, instrument landings and even aviation law. This is no business in which to sit back and rest on past laurels. I'm 47 years old now and still learning. I've seen too many good men lose out because they thought they knew how to fly." Handling a plane is just one of the jobs the captain of a modern airliner has. He has to be an aviator, granted. But he also has to be an engineer, an executive and a constant pupil rolled into one. Lee's superiors in United rate him "tops."

Lee owns a 28-unit apartment house in Glendale, purchased with his savings. His home address is 118 Carr Drive. Between his flights to San Francisco he gives it his personal attention, which probably is the reason he has such a small percentage of vacancies.

Next to flying, the veteran United captain gets his greatest enjoyment out of traveling. He likes to visit strange places and when he can wangle a long enough vacation out of the company he goes traipsing off to Mexico or Central America or Tahiti or Africa. He particularly likes Tahiti. "It's what you expect to find in Hawaii, but don't," he explained. "I'm going back there again some day."

On one of his excursions to Africa, he spent a month in the village of a savage tribe far removed from any point of civilization. "It was a fascinating experience," said Lee. "I didn't see a white man the entire time."

"You know," he added musingly, "That's the real way to get a rest on a vacation."

Lee figures the next 3,000,000 miles are going to be a cinch. "We have all the comforts of home flying these big shops now," said Lee. "They're great airplanes—easy to fly and we sit in a comfortable cockpit. The new planes to come will be better yet. Certainly, it is far less strenuous than freezing to death as we did in the open cockpits of the old single-engined ships we used to fly or roasting to a turn in the trimotors."

"How long has it been since you have had an unscheduled landing on account of mechanical trouble?" Lee was asked. He pondered the question. After a moment's pause, he said:

"By golly, I don't know," he said. "It's been so long I can't remember."

END

Solo from the Start

(*Continued from page* 31)

Stable
Physical
Reacts slowly
Too muscular
Vacillating
Too light (timid)
Jerks (uncoordinated)
Smooth
Responds favorably to stimuli

On this chart would be entered a grade under the "Mental" column, opposite the entry: "Told twice"—"6." The scoring system in this instance regards "10" as the perfect score, "7", average; "5" or below, failure.

Suppose that after several repetitions the student loses control of his temper, quits or becomes antagonistic. A low score would be earned under "Emotional" or "Angers easily" and it is just such things that the instructor wants to know. He wants to know them *before* valuable time and effort is expended. There are too many capable, tractable students waiting and if there were a national emergency, time should be spent only on good material. You would not work on poor material in men any more than you would build your bombers of papier mâché.

After the first hop of 30 minutes you relax. Not much can be gained from short observation: The figures show little correlation at this point so you try to concentrate on the next hop. You want to do what you have been told and do it the first time. Remember in aviation, you seldom have a chance to repeat a mistake. You want to comprehend a little more readily, to accept the cautioning voice of the instructor in the earphones. The next three 30-minute hops are very important because at the end of this time your file will be complete. There will be a series of figures compiled which, in past instances, have proven extremely reliable in determining whether or not you can fly. For example, here are a few:

(Note: A figure of 100 shows perfect correlation, while 00 means there is a haphazard or chance relationship. A figure of — 100 indicates no correlation at all. A figure of + 50 or more is extremely encouraging.)

Correlation between:
Estimated time to solo as determined from Link, and actual time taken 76
Final flight test ratings compared

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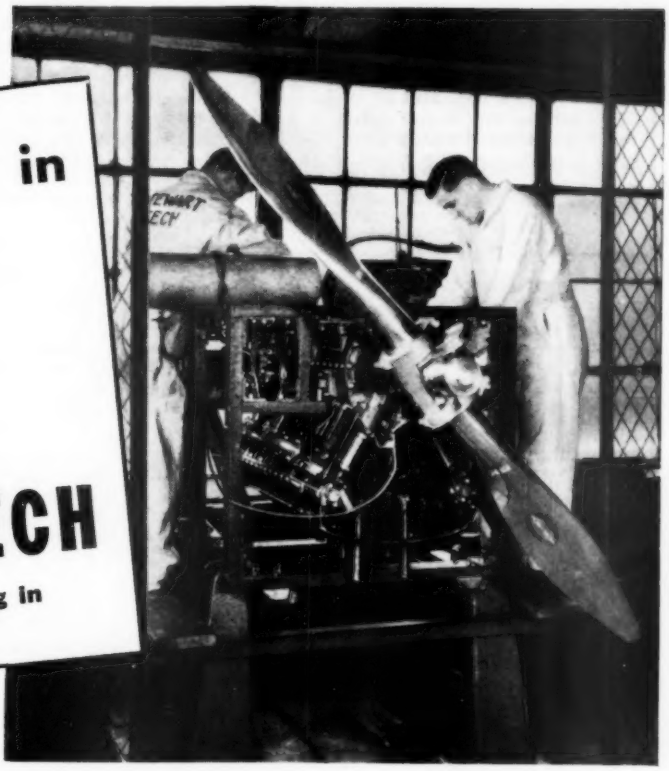

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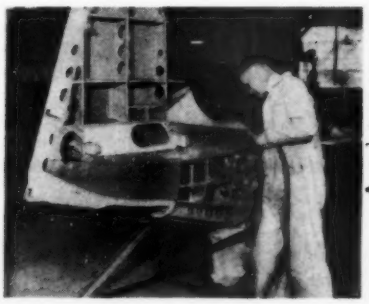

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with estimates made on emotional stability 52

Final flight test ratings compared with estimates made on quickness of learning 62

In one control group of 10 students the two who received the lowest grades on the Link were later dropped from flight training by their instructors. In the same group the three who received the highest grades on the Link were near the top when it came to actual flying. In other words, it seems that after only two hours of instruction indoors one can predict accurately how a student will perform in a real airplane.

One objection, of course, is that there will be errors in predictions. Some ace, like von Richtofen who took plenty of time to solo and then cracked up on his solo flight, would be omitted. Granted, but the day of the ace is over and what we would need desperately in time of emergency would be thousands of good, average pilots who could bomb or dog fight until a possible *blitzkrieg* were repelled. And only by spending time on good material would such numbers be at all possible.

When you complete two hours of instruction in the Link you are definitely ahead of the game. You know how to move the controls, what the word co-ordination means. You can follow instructions. You can assimilate actual flying quicker because the mind is not absorbed with an attempt to make adjustments to a new, strange situation. You could solo sooner if there was any advantage to it or if the regulations permitted. Early soloing is not desirable, however, and therefore you would gain practice in additional air work and landings, making you a safer, headier pilot. There also are a few objections to continued training in the Link and one of them is that Link Trainers are costly. This is true, but the cost of a Link for contact flying is much cheaper because the expensive instruments used in radio beam work are not necessary in contact flying. This also reduces cost of operation, depreciation and upkeep.

Nevertheless, some say, the Link will cost as much as two lightplanes of the Class 1 variety. Why not buy two planes for one Link? The reply is that the Link can fly 24 hours a day. It never has to stop for gas, wind or sunset and only seldom for oil, repairs or checks. It never has forced landings that result in crashes. Moreover it is easier to instruct in a Link than in a lightplane. Have you ever done chain-instructing? That is, taught six students one after the other by taxiing to the line, letting one student out and taking on the next victim? It is a maddening, tedious, exasperating job. The last student really catches it and by "it" we do not refer to something glamorous. Such a situation does not exist in the Link because the nerve strain is at a minimum for both instructor and student.

Others claim that the Link Trainer technique is opposed to that of actual contact flying. For example, you may find that the pressures required on the ailerons when you make a turn are very sensitive. You may find that the nose is high in a spin rather than pointed earthward. The answer is that as much can be accomplished in two hours of training as is desired. What we are interested in is obtaining information relative to a student's aptitude for flying. We are not particularly interested in knowing that the Link will permit him to solo an hour or two sooner than he ordinarily might have. One hour more or less subtracted from his solo time required is not a great deal. But the fact that it may enable us to select a student and tell with fair accuracy whether or not he will become a safe, competent pilot is an extremely valuable asset.

To show the high correlation between the final flight test by the C. A. B. inspector or examiner and the predictions made by the Link instructor, the following figures are tabulated.

Correlation between final check flight grades and:

1. Link competency, end of second hour 76
2. Link competency, sixth hour.. 81
3. Emotional stability in Link... 59
4. Link—understanding directions 58
5. Link—coordination 42
6. Ability after 24 hours actual flying 60
7. Time needed to solo 70
8. Total score on written tests ... 55

The conclusions to be drawn are these:

That you may learn to fly or to solo in a Link Trainer. That you may ascertain whether or not you will ever be able to fly—well, indifferently or not at all. That you definitely can learn to co-ordinate and understand the controls better by preliminary instruction in a Link Trainer classroom. That the difference between the Link Trainer and a real airplane in regard to vertical acceleration, ground work and pressure used on the controls is negligible so far as training purposes are concerned. That the Link will teach a student smoothness, the relation between the controls and self-confidence.

Finally, the correlation between the predictions and the results was so good that some of the flight instructors *requested* that certain students be given Link instructions before reporting to the airport. They felt

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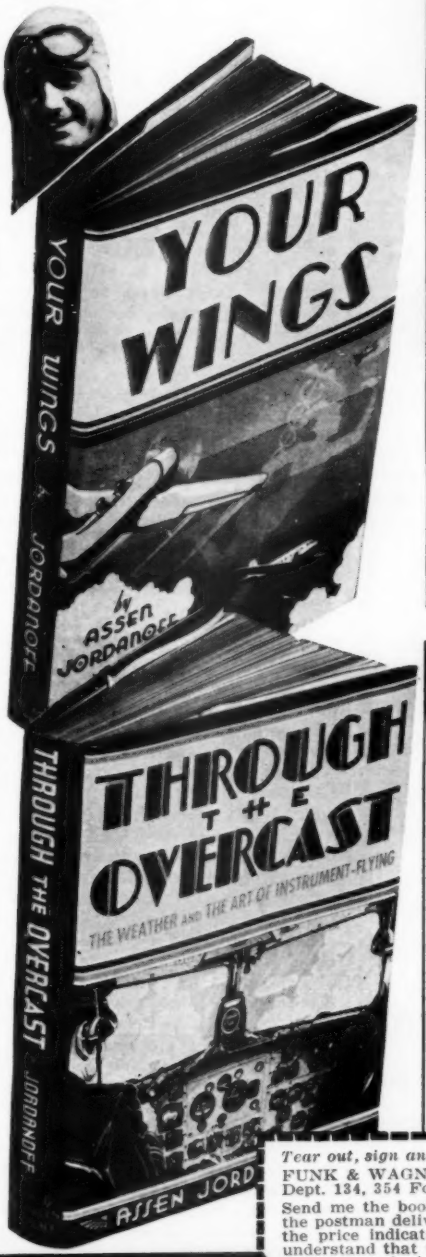

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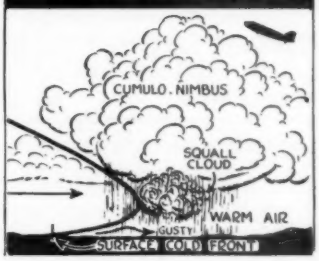

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that it would be of definite value should a particular student prove doubtful. Of course, there are other ways beside the Link Trainer to determine whether or not you are a good risk in aviation, but the other methods do not afford a means of manipulating a stick and rudder.

END

Hoffman

(Continued from page 55)

are able to move an airfoil parallel outward. For flap controls, however, the links of the lower portion should be shorter in order to give the airfoil a larger angle of attack when extended. A portion of the lazy tongs makes up the pantograph, a drafting instrument, shown in Section 4. Its link design is used in operating auxiliary airfoils.

In transmitting a rotating motion through a large angle, bevel gears are used. If the angle, however, is small, then a universal joint is employed. Both are sketched in Section 4. If manufacturing facilities are up to date and space for enclosing a link mechanism within the structure is not available, then the airfoil may be moved along tracks (channels) guided by rollers to any position as shown in a sketch in Section 4. One machine element, the cam illustrated in Section 5, is seldom used in operating control surfaces. Springs must be used to keep the cam follower in contact with the cam, else slotted cams must be designed.

Threaded spindles for adjusting or moving control surfaces are actuated directly by a crank or indirectly by a cable running over pulleys, as shown in the design in Section 5. The crank may be eliminated and the pulley operated by pulling on the cable.

Another mechanism applied to operate auxiliary airfoils is the gear rack and worm drive as depicted in Section 6. It should be mentioned that spindles and gears must be of highest workmanship in order to prevent play in the contact, which may result in a flutter of the airfoil.

Levers operated by cables must be of equal lengths else the cable will slacken at large angle (Section 6). To overcome this the cable must be attached to quadrants as shown in Section 6. The segments may be of any diameter.

The design in Section 7 operates the flap by a sliding tube and rod. The two ends of the rod rotate in two different planes, therefore a ball joint must be provided to take care of the resulting twisting motion. The upper sketch in Section 8 illustrates the application of the above mentioned toggle joint and the lower sketch shows the use of two rods for extending the flap. A very simple design is sketched in Section 9 that increases the wing area by swinging a large portion of the wing around a fulcrum point.

A compact design as shown in Section 10 has the axis of the fork end inclined 45° to the aileron axis. The disadvantage of this design is the telescoping tube connection which may bind at high loadings.

The use of a gear rack and a bell crank is shown in the design in Section 11, that not only extends the flap but also increases its angle of attack necessary for a low landing speed. The upper sketch in Section 12 shows the use of two hydraulic jacks for operating the flap mechanism. The lower sketch in the same section depicts a spoiler control operated by a conventional bell crank equipped with a roller.

Most of the controls are mechanically operated; in Section 13 is a design suggested to let the resultant operate the tab which will move the surface to the opposite side and give a larger restoring moment. The lower sketch shows the use of a tab to reduce the control forces. Flaps attached to rods of different lengths and located as shown in Section 14. Its protruding structure, however, will add too much resistance at high speeds. The lower sketch shows a similar design operated by a hydraulic jack.

Two mechanical units not used in operating control or auxiliary surfaces are the ratchet—illustrated in the upper sketch in Section 15—and the Geneva stop mechanism shown in the lower sketch.

The ratchet converts oscillating motion to a rotating one. The four-slotted Geneva stop mechanism, usually called the Geneva cross, is operated by the pin of the driver until the sector reaches the concave portion of the cross; this stops the mechanism until the pin reaches the slot again.

It is up to the designer to use the minimum number of machine elements to actuate control and auxiliary surfaces. He must know the limits of the available manufacturing facilities. Levers, rods, sliding tubes are preferred. Cables for light loads and easy inspections. Gears for heavy loads and large ships. It will always be a compromise between simplicity of design and manufacturing cost.

END

Licenses

IN its special monthly report to FLYING AND POPULAR AVIATION, the Civil Aeronautics Authority lists the following statistics on the aviation industry:

	Nov. 1	*Oct. 1*
Total licensed pilots	55,000*	44,000*
Airline pilots, licensed	1,318	1,299
Student pilots, licensed	59,745	52,983
Glider pilots, licensed	138	132
Student glider pilots, licensed	489	445
Mechanics, licensed	10,789	10,569
Parachute riggers, licensed	440	435
Aircraft, licensed	15,500*	15,200*
Aircraft, unlicensed	522	519
Gliders, licensed	38	35
Gliders, unlicensed	104	102
Repair stations, licensed	203	203
Ground instructors, licensed	1,450	1,277
Air-traffic control-tower operators, licensed	246	236
Aircraft dispatchers, licensed	310	307

* Estimated

Fixed Guns vs. Free

(*Continued from page 17*)

skis, carrying only four small-caliber machine guns. Using these planes the Finns shot down over 700 Russian planes, most of them twin-engined bombers.

Their method was simple. Using an efficient warning system of outlying listening posts, the fighters took off as soon as the bombers were reported heading inland. The fighters then climbed to the reported altitude of the bombers until the latter were sighted, then headed in the same direction in which the bombers were heading, climbing as fast as possible. By the time the bombers overtook them the fighters had enough of an altitude advantage to catch the bombers by diving. Their usual procedure was to dive at the Russian rear gunner, give him a burst from all four guns and duck under the bomber's tail. With the momentum of the dive they could zoom up and ahead for another pass at the bomber. If they got the rear gunner on the first dive, their next aim was for a burst at the bomber's engines.

As simple as this procedure seems, it was very effective. Using these tactics one Finnish pilot, Captain J. Sarvanto, shot down six modern twin-engined Russian bombers in four minutes. The Russians finally changed their formation from a V of V's to a line formation—but the Finns still picked off the planes on the end of the line.

Recently the Germans varied their tactics from the V formations they used in Belgium and France, trying out a follow-the-leader formation. Still the *Spitfires* and *Hurricanes* are reported to be shooting them down or chasing them back before they reach their objectives. The English are also using patrols of night fighter planes with encouraging results. These fighters patrol over vital objectives, circling in the critical radius where the bombers must come before releasing their bombs. Their method of locating the bombers has not been revealed but it is significant that the English will no longer accept fighters which are not equipped with electrically illuminated reflector-type gun sights, as the telescope sight is no good for night work.

Coincidental with the use of night fighters is the slackening of the protective anti-aircraft barrage around the London area. At the peak of the recent night raids on London, the English were using an estimated half million anti-aircraft shells at a cost of almost $1,000,000. Even with this ruinously expensive barrage, the anti-aircraft was credited with only three per cent to five per cent of the total number of German raiders shot down. In view of this comparative ineffectiveness of anti-aircraft fire, it might be more profitable to eliminate the anti-aircraft and use fighter patrols exclusively. The fighter patrol has several advantages:

1. The fighters are mobile, while the anti-aircraft is limited by a fixed base.

2. The fighter patrol costs only a fraction of the cost of an anti-aircraft "box barrage."

3. The moral effect of the fighters is worse than the anti-aircraft to the enemy. A bomber pilot may ignore anti-aircraft bursts in his vicinity as long as his plane is not struck. But when he sees a fighter headed in his direction, or tracer bullets zipping past him in the dark, he will probably forget all about his bombing run in his efforts to escape.

4. The damage on the ground from anti-aircraft shrapnel and duds often is considerable. In addition, it hampers the operations of the defending fighters.

5. Fighters at high altitude make very little noise, whereas the racket of the anti-aircraft batteries makes sleep impossible for the civilian population, undermining morale and curtailing the efficiency of workers.

Superiority in the air depends upon fighting planes. Poland was helpless after her air force was eliminated. France resisted until her fighters were outnumbered. England was helpless until the *Spitfires* hit their stride and warded off an expected invasion. Fighting planes will probably decide England's fate, and perhaps even America's. What, then, is the best type of fighting plane? We can only judge from the results observed in the proving grounds of the recent wars in Europe.

In the Spanish civil war Russian-built Boeing fighters ruled the air for a time and gave the Germans their idea for the dive bombers they used so effectively

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In 1936 Howard Stark lost his life in the line of duty, with the result that his book gradually receded in the background as outdated. The authors of this book, seeing the inherent value in Stark's original work, purchased the copyright and have written a completely new book around the basic idea of Stark's excellent material.

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[Seal.] M. Gnass, Notary Public. (My commission expires February 26, 1944.)

against Poland, Holland, Belgium and France. In the latter part of their war with Russia, the Finns had an assortment of Italian Fiats, Dutch Fokkers and Koolhovens, French Moranes, English *Hurricanes* and Gloster *Gladiators* and an export model of a U. S.-built fighter (probably the Brewster—Ed.). Although the American fighter had a top speed of only 300 m.p.h., which was somewhat slower than some of the other foreign fighters, several top-ranking Finnish aces told me that they preferred it because:

1. It was faster in a climb.
2. It picked up speed faster in a dive.
3. It was more maneuverable at close quarters, due to the absence of the wingtip stall characteristic of low-wing, taperwing monoplanes.
4. Its armament was heavier; .50 caliber guns would pierce Russian cockpit armor, which repelled bullets from lighter guns.

English pilots now in this country who have seen action recently tell me that the old dogfight tactics have not changed much since the last European war. They say that massed fighter formations still break up into grand *mêlees* consisting of individual dogfights, and that a dogfight still ends up with two planes circling for an opening, with the fighter which can fly the tightest circle winning.

Judging from what we have learned from these last three wars, the ideal fighting plane should have the following accessories and characteristics:

1. Self-sealing oil and fuel tanks.
2. Bullet-proof glass windshields.
3. Armor behind the pilot's seat.
4. Electric reflector-type gun sights.
5. Absence of wingtip stall.
6. *Fast action maneuvering flaps for dog-fighting.*
7. Fast rate of climb. This is more important than excessively high horizontal speed.
8. Fast diving speed.
9. Instrument equipment which permits take-offs with zero-zero visibility.
10. Modern oxygen masks.
11. Heavy guns with explosive projectiles.
12. Turbo-driven supercharged engines.

Maneuverability should not be sacrificed for high horizontal speeds. The above qualifications can easily be met by several U. S. fighters now in production, with a few minor changes. By the addition of turbo-driven superchargers the top speeds of these same models can be increased as much as 50 m.p.h., *with no reduction in maneuverability or change in handling characteristics.*

Most of these items are already incorporated in the fighting planes of the Axis powers. Unless we give our pilots similar equipment at once, we may be caught short—just as France was—and sooner than we expect.

END

Want a Job?

(*Continued from page 54*)

although this soon may not be the case.

* * *

We were going to cover the requirements for clerical aircraft factory or airline workers this month. However, since most of our letters seem to have been written by people who were interested in drafting, we'll outline the *minimum* requirements for beginning draftsmen. Applicants must bear in mind, however, that there are many experienced draftsmen on the labor market at present and that their employment will depend on the law of supply and demand.

Job Analysis

POSITION: Detail draftsman, beginner.

WORK DONE: Detail drafting of aircraft parts and assemblies, under the supervision of a group leader. Tracing.

PROMOTIONAL FORM: This is a beginner's job.

WAGES: From 40 to 60 cents an hour, depending on the location of the plant and its wage scale.

EDUCATION: High school or trade school drafting course. A good knowledge of higher mathematics.

EXPERIENCE: No previous employment is required, although men with drafting experience in other lines are naturally preferred. Specialists in such fields as electricity, hydraulics, radio, etc., often are in demand. Neatness and good draftsmanship are essential. (Specimens of applicant's work should be submitted with application.)

POSSIBILITIES FOR ADVANCEMENT: Many aircraft design men are promoted from the ranks of detail draftsmen. A man with the minimum requirements outlined above is limited to the most elementary work. Advancement depends on his securing special training after employment, in aircraft design and aeronautical engineering, either through night school or correspondence courses.

REMARKS: Junior draftsmen are also used in almost every manufacturing industry. A few of these are: automobile manufacturing, steel, petroleum, airlines, construction firms, radio manufacturing, road construction, surveying, machine-tool manufacture, aircraft parts sub-contractors, etc. The requirements in most of these lines are about as listed above.

* * *

We had a letter from J.D. of Katonah, N. Y. J.D. has had 12 years' garage and general shop experience in overhauling motors and electrical units and in weld-

ing, lathe work and electrical trouble-shooting. He inquires as to whether he should apply for Air Corps service if he is called in the draft. We believe he should, since his experience would make him potentially valuable as an aircraft engine mechanic. As to his chances of getting on at an aircraft factory, we believe that they are very good. We do not know just where in New York Katonah is located, but we refer him to the manufacturers we listed for R.L. earlier in this column. He should apply in person at their employment offices and give his interviewer all the information he can as to his experience. We believe he would be best suited to work in metal fitting, electrical maintenance, or as a junior engine mechanic. He might also try the Pratt & Whitney aircraft engine plant, which is located in East Hartford, Conn.

* * *

G.H. of Philadelphia is a power punch-press operator of seven years' experience. He can also run a drill press and has done spot-welding. He has been employed by several large companies, for one of them over a period of four years.

G.H. complains that he cannot find work, stating that he has tried the New York and Pennsylvania State Employment Bureaus, as well as a number of private concerns. We cannot see any reason why, with his experience, G.H. should not be able easily to land a job with one of the larger manufacturers. Most of them are hiring men with his qualifications every day. But while we know nothing of those in New York and Pennsylvania, our own observation of state employment bureaus has led us to believe that—with a few brilliant exceptions—it is worse than useless for a man to apply for work at one of them. Some day, no doubt, the citizens of this country will get around to cleaning them up. In the meantime, we'll have to keep on finding jobs for ourselves.

* * *

Our advice to J.H. is to write a letter to the Martin company in Baltimore, listing his experience and explaining that he is a seaman. He can also tell them that his run takes him into Baltimore and that he would very much appreciate an interview with them next time he is there. When and if he gets an answer, he can make arrangements by telephone for an interview with the man whose signature is on the letter. If he doesn't get a favorable answer, he will have to stand in line at the employment office until he is interviewed. The greatest handicap he will have is that most companies hiring men want them to be on call at a moment's notice. If he is out on a trip when they call him to work, his place may be taken by another man who is on the spot. Perhaps, though, if he explains his unusual situation to his interviewer they can, between them, figure out some way for him to get sufficient notice. Our experience has been that employment men will show you every consideration if you relax and treat them like human beings instead of ogres.

* * *

L. C. of Charles City, Ia., has had 10 years' experience in sheet metal production work, including four years as supervisor and inspector. He certainly has the qualifications for aircraft sheet metal work, but why does he want to change employment? He is probably making better wages now than he would be able to get from an airplane factory to start—and sheet metal work is, after all, sheet metal work. Aside from that, the distance that separates him from the centers of aircraft production would be a distinct handicap. If, however, he decides he does want to change, we'd suggest that he use the letter method we recommended to H.S.H. earlier in this column. This should get some results.

* * *

Well, that's about all we have room for. Except that we'll take time to tell C.S. of Des Moines, Ia., that we're going to try to cover requirements for clerical workers in all branches of the industry next month. We're also going out to one of the airlines and look into the specialized jobs *they* have to offer. But keep those letters coming! . . . After all, this is your column, and you might as well have the stuff in it that you want to know about. Also, we *would* like a post card from any of you who land jobs. Aside from making us feel good, it'll help us to keep in touch with who's hiring what—and where! List your qualifications and tell us how you got your job. We'll pass the information along to someone else who will profit from your experience.

END

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I Learned About . . .

(*Continued from page 35*)

but it was to look good later.

We were past the ragged pass and shining Summit Lake was ahead when the motor coughed, stuttered, paused. We were chattering about something but choked to sudden silence. I pumped the throttle and the motor started. We looked at each other in frozen shock. It was running rough and nothing is worse than not knowing how much danger you face. A shorted plug, wet by the rain squalls? But I was sure the motor was too well cowled and, anyhow, the miss should be more constant if it was plug trouble. Water or dirt in the gas? If that, then complete failure might come any minute. I climbed for more margin.

Then the motor banged, stopped again, started as I levelled out of our climb, stopped . . . and then snarled back into an ear-racking pounding like a boiler shop at top production. I grabbed the map frantically. To turn back into Isabel Pass might be suicide. A crash landing on the slavering peaks if we did not reach Rapids 30 miles back would be no matter of sheared-off wings. The road, strung along the edge of the mountains, was too winding to set down on. It was either the road below us, narrow and shelving as it was, or the next field 75 miles beyond at Gakona with rolling hills, stunted trees and tundra between us and safety.

Tundra is the sparse covering of much of the sub-Arctic. Frozen ground, melted a scant few feet in the summer, is covered with moss and weeds. Buckled into domes by the freeze-up, the thaw leaves almost hollow caps of knotted vegetation that almost invariably noses over a plane forced down on it. If we went down in a wooded area the plane would be washed out, although we should probably not be hurt, for the plane would be landing slowly and the roots of the slender trees are massed in a funny shallow little pancake hardly more than a yard across and not a foot under the surface.

To one side wound the highway, though, and perhaps we could get down there. I wheeled the plane over, levelled over the narrow, snaky road and lifted the nose skyward for an exploratory moment. The air speed dropped alarmingly, so we levelled again.

We still had 1,800 revs of our normal 2,350 cruising, oil pressure was up, temperature was normal. Wing temperature was up now to 45° so we didn't have to worry about icing at least. Vibration threatened to tear the engine bodily from the mount, though, and air speed was down to 60 m.p.h. But we had 6,200 feet and, if the motor didn't conk completely and if it stayed on the plane, we should make Gakona in about 50 minutes. I looked at Howard.

"Here's the situation," I told him. "We have a fair chance. If we land on the road we probably lose wings and landing gear, but we probably won't be hurt. If we go on, we'll possibly get to Gakona even though we're settling. But we may lose the motor and I doubt if I can land

★★★★★★★★★★★★

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★★★★★★★★★★★★

if the motor tears lose. It's your life, too. Shall we make a crash landing or gamble on the ship hanging together?"

I should have known Howard better. It was his first cross-country, his second airplane flight—but he races outboard motors for championships and his eyes were shining.

"Go on!" he said. "Gosh, this is swell! I wouldn't trade this thrill for a thousand dollars!" I felt a sudden irritated urge to tell him to save his thousand dollars, he might need it for a funeral, then I laughed. Good guy. I turned to nursing the plane along.

My throat was swollen shut with plain fright, but the ship was under good control even though the stick was making my hands tingle and shoulders ache and the rudder pedals were spanking my feet. The engine was turning an even 1,800, but we were settling. In 15 minutes we were down to 5,000 feet. A quick check of the map showed Gakona still all of 50 miles away. A private field belonging to a mine was about 30 miles to one side of our course, another about the same or a little closer on the other side. But below us was the Valdez Trail where we might land if worse came to worst. Between us and those other two fields was only tundra and trees. We clung to the path above the road and clattered on.

About 35 miles further on there was a clank in the engine that stopped Time for a frozen moment as the propeller stood still across our horrified vision for a third time—and for the third time it started again. But now the noise was worse, we lost another 150 r.p.m., and vibration increased. Now we were settling at an even 100 feet per minute. Then Poplar Grove, an Alaskan Road Commission camp, came below. Men ran out of their tents, staring up at us as we limped along. The road widened here. Perhaps we could land. But Gakona was only ten miles beyond now. We staggered on.

Gakona is five miles off the road, a trading post built in the days when freight came up the Copper River. On the farther side of the Copper River Canyon, at right angles across our course, is Gulkana with a fair field, but we could have never raised our nose to climb the slope on that side. We wheeled eastward and sighted the airport of the post.

Alongside the field, like a tired horse that drops at the end of the race, our motor stopped dead. No false alarm this time, no shamming. It was dead. I cut the switch and set the stabilizer with shaking fingers. We glided around the field into the wind, slipped to lose the last thousand feet of precious altitude and dropped onto the grassy runway. We climbed out, waved at the approaching Indians with quivering nonchalance and called it good. Fifty-five minutes even of mortal fright, and safety!

Two cylinders were cold. A valve stem had broken between the circlets that hold it in place and, for the 15 minutes it had run with only an occasional miss, it had been riding up and down, hanging by its rings. Then slipping sideways, the head had been broken off and driven into the piston. That cylinder had then cut out immediately. The other cylinder had eventually cut out with plugs fouled by backed up gasses. I shivered again as I noticed that the paint had been flaked off the mount by the shuddering of the tortured motor.

Howard went on by truck and I went back to Fairbanks with the engine, but on our Fairbanks-bound truck there was a large and invisible load on which we paid no toll at the ferry. It was a load of thanks for the 5,000 feet of spare altitude that we had had by chance alone.

I learned about flying from that. From here on out, over bad country Alma flies high. My apologies, Bill. You were right.

END

Flight Instruction

(*Continued from page 28*)

h. Location of fire extinguisher.
i. Location of first-aid kit.
j. Warnings:
   1. Propeller danger.
   2. Running engine with empty cockpit.
   3. Local traffic rules.
k. Instruction signals.

Additional ground instruction (to be given sometime before solo).

a. Starting procedure.
b. Swinging propeller.
c. Warming up engine.
d. Stopping engine.

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e. Line inspection of aircraft.
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Note: Students should be permitted to solo at any time after eight hours when in the opinion of their instructors they are qualified. The order of teaching a and time spent on the following maneuvers is left to the instructor's judgment to suit his conditions and personnel. Instruction periods should be approximately 30 minutes each. All landing practice without power.

1. TAXING TO PROFICIENCY (to be given with daily instruction throughout dual periods while taxiing from line to point of take-off and from point of landing to line):
   a. Into wind.
2. AIR WORK:
   b. Cross-wind.
   c. Down-wind.
   d. Gusty air.
   a. First flight—orientation.
   b. Straight and level flight.
   c. Turns: medium and precision to be introduced as soon as possible.
   d. Coordination exercises: "S" turns, elementary eights.
   e. Confidence maneuvers.
   f. Normal climbs and glides.
   g. Turns in climbs and glides, including "S" patterns.
   h. Rectangular course around ground object—right and left.
   i. Stalls from left flight and turns.
   j. Steep power turns—right and left.
3. TAKE-OFFS (explanation of difference between ground and air speed; effect of wind velocity and direction):
   a. Into wind.
   b. Cross-wind (demonstrate).
4. LANDINGS (using 90° and 180° approaches with explanation of key position):
   a. Into wind.
   b. Cross-wind (demonstrate).
5. SPINS (never to exceed three turns):
   a. Normal entry and recovery.
   b. Accidental spins—demonstrations of inadvertent entries from climbing turns, steep turns (both with and without power) and from skidding turns; student to be shown what is meant by "cross controls" and warned to avoid such use.
6. SIMULATED FORCED LANDINGS (emphasis placed on right approaches):
   a. One take-off with less than 200 feet of altitude.
   b. 90° with over 200 feet of altitude.
   c. 180° above 400 feet of altitude, to be given on all periods after landing practice has commenced.

Stage B

(Primary solo—minimum three hours solo—one hour check to be given as instructor deems necessary.)

7. SOLO FLIGHT.
8. SOLO PRACTICE: Work of stage A periods 1, 2 (except e, i, j) 3, 4 only. All take-offs and landings into wind only. All landing practice without power."

Stage C

(Advanced solo—minimum 15 hours solo—eight hours dual.)

Note: In Stage C, length of instruction and solo periods is left to the discretion of the instructor after judging student and his tendency to tire. Amount of dual and solo time is suggested but final determination is up to the instructor; however, 50 per cent of indicated periods is required. Four hours

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are allowed for periods 16 and 17, to be assigned as instructor deems necessary. Simulated forced landings should be given on all dual periods, becoming proportionately difficult as student progresses.

9. INSTRUCTION (one hour). SOLO PRACTICE (two hours):
   a. Precision landings (180° side approach, altitude not to exceed 1,000 feet.
   b. 30° eights around pylons (altitude 500 feet—maximum starting bank 30°.
10. INSTRUCTION (one hour). SOLO PRACTICE (one hour):
   a. Review Period 9.
   b. Advanced stalls.
   c. Spins with N.A.C.A. recovery (never to exceed three turns).
11. INSTRUCTION (one hour). SOLO PRACTICE (two hours):
   a. Review period 10.
   b. Precision landings (360° overhead approach—altitude not to exceed 1,500 feet).
   c. 70° power turns (720° precision).
12. INSTRUCTION (one hour). SOLO PRACTICE (two hours):
   a. Review period 11.
   b. Precision landings (spiral approach —minimum two turns—altitude not to exceed 2,000 feet).
   c. 70° eights around pylons (altitude 800 feet—minimum starting bank 70°).

Stage D

13. INSTRUCTION (one hour). SOLO PRACTICE (two hours):
   a. Review period 12.
   b. Cross-wind take-offs and landings.
   c. Slips (forward and side).
14. INSTRUCTION (one hour). SOLO PRACTICE (one hour):
   a. Review period 13.
   b. Power approaches and power landings.
   c. "Dragging" fields (instruction only).
15. INSTRUCTION (one hour). SOLO PRACTICE (two hours):
   a. Review period 14.
   b. Cross-country.
   c. Solo—cross-country 50 miles, minimum, and two full stop landings at different airports—triangular course.
16. INSTRUCTION AS NEEDED. SOLO PRACTICE AS NEEDED.
   Complete private flight test given by instructor and student goes through two complete tests alone and practices maneuvers as needed.
17. CHECK BY INSTRUCTOR FOR PRIVATE FLIGHT TEST.
   Discussion of maneuvers will be carried on before and after each flight. Coordination exercises are to be practiced whenever possible in climbs, glides and going to and from practice areas.

The presentation of the items in this course is to be in accordance with the explanations and precautions outlined in the "Flight Instructors' Manual," Civil Aeronautics Bulletin No. 5.

END

Air Sign

THE first electric advertising sign designed to be seen only by people traveling by air has just been completed on a factory adjacent to Chicago Municipal Airport.

You Don't Say!

(*Continued from page 54*)

have been court-martialed for ordering the thousands of U. S. aircraft now being built and delivered to the Royal Air Force.—Ed.

Suggestion

Sirs:

I am still much of a novice at this flying game—having about 35 hours and a private license—and the other day I inadvertently flew through another plane's slipstream, which is quite a peculiar experience . . . I would like to see an article on the dangers of getting into slipstreams while taking off or landing or at low altitudes. I'd also like to know the minimum distance at which one would be safe behind an airliner, as they kick up quite a turbulence . . .

FRANK N. BUCKLEY.
Vancouver, Canada.

Correction!

Sirs:

I have noticed in FLYING AND POPULAR AVIATION . . . that the United States is referred to as America and Canada as Canada. It seems to me that this is an insult to Canada and should be corrected before readers in Canada make objection to this. As a citizen of the U. S., I believe we are the most progressive nation of the Americas, but this does not justify

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● No Canadians have objected yet.—Ed.

Bigger

Sirs:

In the November issue . . . we have come across "The Care and Treatment of a Lightplane" by Harvey Martin. In a synopsis of Mr. Martin's history it is stated that he "has probably sold, delivered and serviced more lightplanes than any other man in aviation history. He is credited with putting more than 300 in the hands of private flyers and operators." We wish to take exception to this statement, inasmuch as we have been the largest distributor in the Piper *Cub* organization for the past three years, which statement can be attested to by the Piper Aircraft Corporation . . . Our total sales will far exceed 300 . . .

J. C. LONGSTREET,

Manager, Bennett Air Service, Inc.

Hightstown, N. J.

Sorry . . .

Sirs:

Is it possible to get those front cover color pictures, suitable for framing, and what would the price be? Also, is it possible to get some of the black and white pictures, especially those you run on full pages?

DON POWERS.

Indianola, Ia.

● All FLYING AND POPULAR AVIATION front covers are made from Kodachrome transparencies. Cover plates are made directly from these transparencies, hence there actually is no full-sized original as many readers think. Black and white pictures usually are enlarged from the original glossy print. The latter must be kept in our photographic files for further use and cannot be sold.—Ed.

Baked Engine Trouble

Sirs:

We wish to draw your attention to "Baked Engines" (November, 1940). This company has the British Empire rights for this engine. In the first column, it mentions that an R.A.F. investigating board completed a block test of the 1,250 h.p. 12-cylinder engine . . . As far as this company is aware, no large engine of this description has been in Canada. A small engine of approximately 25 h.p., weighing in the neighborhood of 32 pounds, was sent to Canada for test purposes and the R.C.A.F. technical department inspected it, but no block tests were made. It also was demonstrated in Ottawa. We are unaware of any investigation by the R.A.F. of England, but if such has been the case, it has been without the knowledge of this company . . . and we probably would have been acquainted with such developments. We can definitely state that an order for an engine for the Supermarine *Spitfire* has not been placed with the All Steel Engine Company through us.

While the All Steel Engine Company representatives were in Ottawa, the impression was given that the R.C.A.F. would be pleased to check an engine of this size and the company's representatives informed our authorities that an engine of this size was then being tested at Wright Field. So far, however, we have been unable to ascertain confirmation of this . . . Whether an engine of large horsepower can be successfully built of this design, we as yet are unable to state, but we understand that the All Steel Engine Company has two large engines under construction in San Francisco at the present time and we may state that the R.C.A.F. is interested in watching the construction of these engines, an official representative being in San Francisco at the present time for this purpose . . .

ALEX JOHNSON,

Vancouver Sales & Appraisals Limited.

Vancouver, Canada.

False Praise

Sirs:

It seems a shame that Nazi military planes are praised so highly . . . Praise of the *Stuka* dive bomber, for example, disturbs the morale of the average person . . . Yet the *Stuka* is no more than a converted Junkers . . . and its greatest threat is its large numbers . . . Some of our own obsolete fighters are far more speedy, maneuverable and threat to an enemy. . . .

GILBERT RICHARDS.

Camden, Me.

● The *Stuka* is the old Junkers Ju-87 which first saw service in the Spanish Civil War.—Ed.

END

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Movie Soldiers

(*Continued from page* 25)

Whenever available, officers who developed the original technical processes shown are called in to advise. Hollywood's press agents ballyhoo the great care used by the film producers in making details correct. But their films are for the general public, which cares little about technical inaccuracies. But Air Corps films are for a specialist audience —engineers, pilots, technicians, mechanics—who will catch any slip quickly. More important still, the educational value of a film is lost with inaccuracy.

Special care is taken in the animation sequences. After consulting with technical experts Chief Animator Fitzgerald "roughs out" a series of sketches showing the action to be portrayed. These guide his staff in preparing detailed drawings.

"Animation," he explains, "is of particular value in technical films because it enables the film to point out precisely the essential details in a new process or new piece of equipment, without the non-essentials. Frequently it is extremely difficult or even impossible to get actual motion pictures showing the ideal operation of a process or piece of equipment. But so long as the artist understands what he is drawing it is comparatively simple for him to break down the subject into a sequence of drawings which illustrate it exactly."

Fitzgerald himself transfers the finished drawings to movie film, photographing them with a special overhead

camera. While the studio is at work Captain Fite, Hagemeyer, their two cameramen and Soundman Svancara are making the photographic and sound sequences which form the bulk of the picture. For the automatic landing film virtually all this work was done at Wright Field. But frequently the crew flies to other Air Corps fields for pictures. In January they recorded the Air Corps show at Bolling Field, given to show the progress of the Air Corps expansion program to President Roosevelt and Congress.

Some of the most exciting work comes in making aerial movies. Hazards may not be what they were in the early days, but just the same—

The movie makers still are being ribbed at Wright Field about the parachute jump pictures they missed last October. Capt. M. C. Woodbury, crack Wright Field pilot, had been detailed to put a training plane through some acrobatics needed for a technical film. The lumbering Martin B-10B cruised alongside to get the pictures but Woodbury didn't "go into his routine." Instead he waved to the movie crew, pointing his hand down to the ground. Capt. Harold Bowman, then chief of the unit and since transferred to Washington, signaled back to Woodbury to get started on his stunting. Instead, the other flyer made an awkward skidding turn and kept flying at the same level. They didn't have radio inter-communication.

Finally the movie crew decided something was wrong and headed down for a landing. They were right; something was wrong. The trainer's controls were jammed. All Woodbury could do was continue to fly level and make those silly-looking skidding turns. For an hour he struggled with the controls. Then, with fuel tank almost dry, he decided to jump. He made his jump from the wing—and his weight on the wing pushed the plane into a gentle bank. Also, he pulled his rip cord while too close to the ship. As he floated down, the plane followed him in wide sweeping circles that came uncomfortably close. When he reached the ground he was unhurt—but his parachute bore bright yellow paint from contact with the trainer's wing, and the canopy had three minor rips and five broken shroud lines. Had the movie plane waited around, the crew could have taken the first actual motion picture closeups of an emergency parachute jump. Much of of the movie lab's operations, of course, have to do with processing exposed films. A new machine system for developing and drying reels of film now is being constructed. The positive prints are run through an editing machine for cutting.

Improved results in sound recordings now are being obtained with the installation of a new sound recorder, said to be unequalled between New York and Hollywood. It will mix the sounds from four separate sound tracks into one combination. It used to be that the commentator gave his technical lecture into a mike which, at the same time was picking up background noises of airplane motors, shouts of mechanics and any weather sound effects, such as thunder, which were wanted. But sounds many times were jumbled by this method, or they were distorted.

Now Captain Fite makes his comments in the sound-proofed recording room and the other sound tracks are blended in to provide the necessary background for the final accompaniment. When the picture is finished the whole unit gets a preview. In a compact little projection room accommodating about 25 people, they pass unsparing judgment on their own product before it goes out to Randolph or Kelly Fields, or one of the regular air bases as another aid in the Air Corps' program of education.

END

Check Your Lights

NOW that daylight hours are shorter, pilots will find themselves doing some night flying whereas they did none during summer months. Hence Aero Insurance Underwriters warn plane owners to check navigation lights carefully. According to the C.A.B. it is possible that, through disuse and neglect, these lights can have lost as much as 50 per cent of their rated candlepower—which is in violation of the C.A.R. The glasses should be cleaned inside and out, bulbs should be replaced if darkened or loose at the base, reflectors should be polished and the contact points of the bulb and socket cleaned with fine sandpaper.

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(*Continued from page 38*)

ber piece by piece and, when the manually-operated equipment was uncovered and the ship landed safely, the grinning ground crew—which didn't like to work—found the ship already empty. Several thousand feet of expensive lumber long afterward was visible on the mountain sides.

Smith had another amusing experience in trying to get another interior landing field for the line's use in ferrying supplies to another mine. The only possible field Smith could find on a muleback expedition was one used by a tribe of Indians for a corn field. Negotiating through an Indian-speaking interpreter Smith offered the Indians money for use of the field, but the Indians weren't interested. Money didn't mean anything to them and they resented the strangers and, as the negotiations went on, the Indians became increasingly hostile.

"You'd better get on your mule," the interpreter whispered to Smith in English, then turned back to the Indians. Suddenly the interpreter whipped his mule. Smith did likewise and they dashed away as the Indians showered them with stones and clubs and other missiles. No, they didn't get the field.

Smith also flew one of the *Condors* well into Brazil in an effort to find a possible landing field which might be used to carry out mahogany lumber. He found vast forests of mahogany—worth scores of millions of dollars at present mahogany prices if only it could be brought out—but not a single spot in which a plane could land safely.

Tiring of the hard life in Peru, Smith returned to the United States, determined that there are innumerable opportunities for handling freight by air in the United States as well as elsewhere in the world, once the business is set up.

"Some day, in the not far distant future," he predicts, "you will find a lot of freight flying in the United States, especially the lightweight freight that must go long distances. And it will be made possible in part by the lessons we learned in South America.

Smith has had his share of adventure in flying the airlines in the United States. For example, while flying a mail plane one dark night near Washington, he suddenly found his little ship caught in the glare of a gigantic searchlight and saw some big gun explosions near the light on the ground.

"My God," he yelled, "they're trying to shoot me down!"

He tried to duck out of the searchlight's beam, but dodge as he would the beam clung tenaciously to the plane. Finally he landed at Washington airport, beads of sweat on his forehead, to find that a Coast Artillery unit had been practicing and had thought his plane was one which had been sent out for the practice. The gun bursts he had seen were blanks.

Another time, while flying a load of passengers from Washington, one of the passengers suddenly went mad, got out of his seat, mutteringly, threateningly and began tearing another passenger's shirt.

"Sit down," shouted Smith at his passenger—who then turned his attention to Smith. The ship carried no co-pilot or steward and things really looked bad for a time. But other passengers quickly overpowered the man and Smith landed at Cheatham, Va., turning over his passenger to police.

END

Uncle Sam's FLYING CAMERA

Photograph by U. S. Army Air Corps, Bolling Field, D. C.

Chalk up another "first" for the U. S. Army Air Corps. It has just put into service an ultra-modern fleet of "flying cameras" . . . the finest photographic ships in the world! Don't fail to read all about these huge twin-engined camera planes, Uncle Sam's latest weapon for defense, in an exclusive article by POPULAR PHOTOGRAPHY'S Washington correspondent. You'll find this timely and brilliantly illustrated account of the Air Corps' photographic squadron beginning on page 23 of the

JANUARY ISSUE

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AOPA News

(*Continued from page 48*)

form was primarily drawn up for fixed base operators and instructors, so that they might have something to present to their solo pilots. The demand for these certificates is increasing and we think that every instructor and fixed base operator would like to have a stack on hand for his students. The certificate is printed on parchment-like paper and makes a handsome memento of an important chapter in every pilot's life—his first solo flight. Write to AOPA, Transportation Building, Chicago, Ill., for a sample copy or a supply.

Booster Members

First AOPA members to qualify for the Booster-Member identification wrist tags have already had their awards mailed to them. Don't forget, every AOPA member who obtains *five new members* will be sent this new AOPA wrist tag showing member's name and AOPA-registration number. Members should be sure and affix to the bottom of each applicant's new application their own name and the initials "BM" so that we will be able to properly credit the application toward the wrist-tag award.

Vigilance: The Price of Freedom

There probably isn't a pilot in the country who has not heard some stories or rumors about "private flying being grounded on 'M' day." AOPA has been sitting in on many important hearings in Washington.

There may be *local* circumstances at some cities which occasionally do not find their way into our office until it is too late to be of service. Particularly in cities where there are no AOPA Units located (fortunately most major cities do not have active AOPA Units), matters of extreme importance may be slow in coming to our attention. Won't *you* act as a committee of one and advise the AOPA *immediately* regarding any developments which you may feel as unjust or against the interests of non-scheduled flying? The European war has brought on many complications, many of which have not yet come to the surface. Join the AOPA and help to *point up all private and non-scheduled flying in a single all-powerful voice.* If you belong to a local or state organization, talk to your chairman or president and urge him to affiliate his organization with the AOPA. This is the time for alertness and *singleness of purpose.* Pilots must combine now and cooperate for the fundamental rights and liberties of non-scheduled aviation.

END

The Guide

(Continued from page 42)

let you land, even if you are only some 66 flying hours from the healthful Pacific Coast and regardless of your $760 one-way fare. And never fly into the Philippines from Hong Kong for a visit with your fourth cousin in Manila between Clipped flights, unless you have smallpox vaccination and cholera inoculation certificates from Hong Kong health officials. And don't go to Costa Rica as a tourist, unless you have a round trip ticket or "transportation beyond" to another country to which you "will be admitted." *And,* even if only passing through, you must have a health certificate and—apparently more important — "sufficient funds to cover" your expenses before you step upon Uncle Sam's Panama Canal Zone or its adjoining Republic of Panama.

That is all a bit away from the Guide's purpose of telling you when and where and at what time you can catch that plane and at what time you will arrive. But it is a safe bet you will never even know that the blue covered navigator is plotting your course next time you step up to that desk and ask for a ticket for a town 300 miles down the line or for Tayoltita, Cienfuegos, Pocos de Caldas or Pakanbaroe. And, simmering over a blundering printer's error, wrapped up in some short lines of type, without even thinking of a sunny, blue Lake Michigan out there behind his back, will be one of the Official Aviation Guide fellows who is plotting your course to those exotic scenes.

END

Busy Airline

ONE major airline, American Airlines, carried 93,376 passengers in a single month (September, 1940). This is an increase of 63.1 per cent over 1939.

Dead-Stick Shot

THE Army Air Corps' North American BT-14 above is making a dead-stick landing for the especial benefit of the Paramount cameraman over whom the ship's wing is about to pass. Note the fake bush in front of ship for pilot to aim at. Occasion was the recent visit to Randolph Field of camera crews now engaged in filming "I Wanted Wings," adapted from the book of the same name by its author, Lieut. Beirne Lay, Jr. It is the story of the training of an Army pilot.

Insurance Rates Drop

BECAUSE the scheduled airlines have set up an unprecedented safety record during recent years, the Pacific Mutual Life Insurance Company of Los Angeles recently announced that it was removing all restrictions on air travel in the United States and acceptance of business at standard rates, providing passengers used the regularly scheduled services of the passenger-carrying airlines. Further data can be had by writing J. N. Abercrombie, Pacific Mutual Company, 523 W. Sixth St., Los Angeles.

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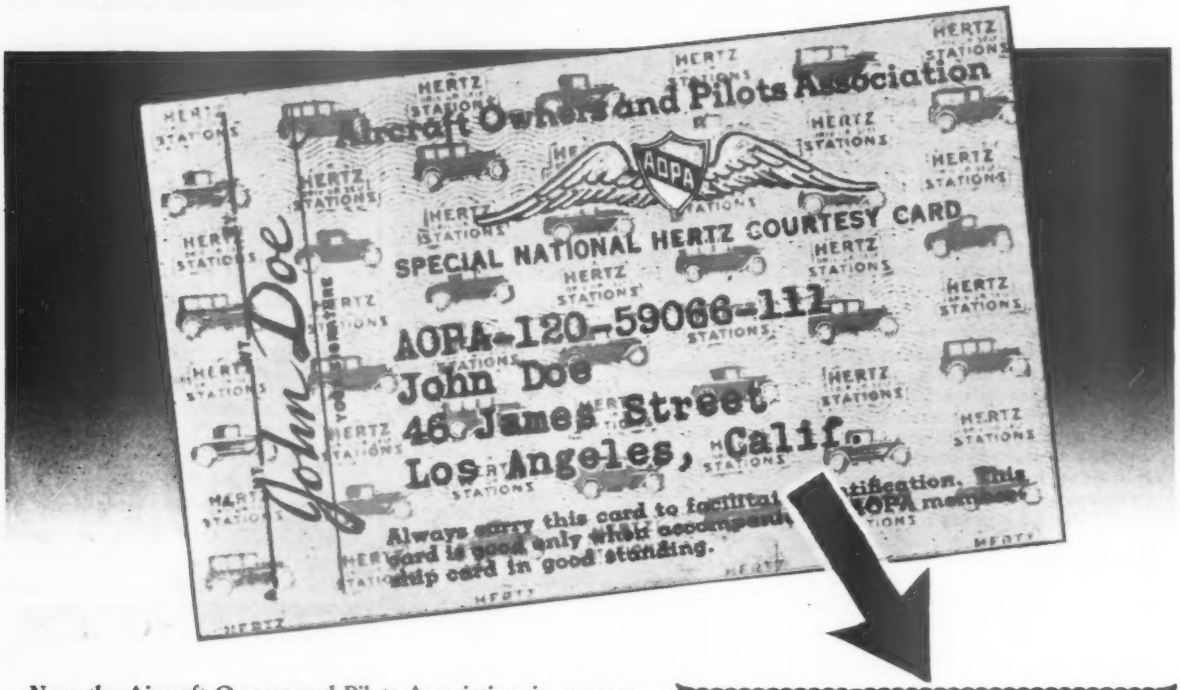

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An Airy Chat with the Editor

(*Continued from page 4*)

WHAT'S-IN-THE-WIND . . . One of the west coast manufacturers is working on a big seaplane that can be launched from a land catapult . . . which would be the American answer to Britain's pick-a-back experiment . . . AOPA's Air Guard soon may be taken over by the Army . . . Can any reader suggest some soft material, like sawdust, from which a landing strip for *seaplanes* could be made on an airport? . . . Laugh-of-the-month: Tommy Tomlinson, TWA's he-man vice president, on a kids' radio program dealing with TWA's high-flying *Stratoliners*, saying to one of the radio characters: "I am pleased to throw this handful of stardust in your face" . . . meaning the radio fellow was officially a member of the Stratoliner Club! . . . Bill Lear may set up a new radio factory in Chicago . . . Love is really blooming! FLYING Authors MacDonald Hays, James L. H. Peck (page 32) and Robert A. Winston (page 16) either were recently married or will be shortly . . . Early in the war, we're told, German Dornier Do-17's were such cold meat for British pursuit pilots that 15 German pilots refused to fly a mission over England one day and were lined up and shot . . . 50 Ryan ST trainers now are being built for the Netherlands East Indies government . . . that government also is after some pursuit ships and Martin patrol boats . . . It is not widely known that a number of Curtiss *Hawks* recently were delivered to Iran . . . The Martin company recently got a contract for $106,125,396 worth of planes (probably PBM patrol boats) from the Navy . . . A recent fire at the Waco company, Troy, O., probably will cost them $10,000 . . . The British have raised the age limit for pilot recruits from 28 to 31 years . . . During the first nine months of 1940 the British bought $77,256,731 worth of airplanes . . . Did the Fairey *Swordfish* torpedo planes that recently sank part of the Italian navy in Taranto harbor do that dangerous night flying just a few feet off the water using American radio altimeters? . . .

The Army recently bought: $1,531,331.10 worth of wheels and brakes from the Goodyear company, $963,500 worth of compasses from the Pioneer instrument company, $2,745,985 worth of altimeters from Kollsman, $131,306,962.21 worth of engines from Wright and $122,323,020 worth of aircraft engines from Ford . . . The Navy bought $662,044 worth of Link Trainers . . . Cornelius Vanderbilt Whitney, a Pan American Airways director, has a press agent sending out publicity about him . . . a recent release tells how Whitney, when he was 17, became a full-fledged Army pilot after 1½ hours of instruction . . . There is at least one major move afoot in Washington to ground all private flyers . . . Admiral Towers, head of Naval aviation, recently advocated grounding private planes lest they fly over powder plants and drop small bombs on them . . . 50 Lockheed *Hudsons* are being fitted with extra gas tanks so that they can be flown across the Atlantic . . . Ferry flights to Britain of Consolidated PBY's and Model 31's are expected to start soon . . . The British soon will be using a new bomb sight fitted with an explosive device set to automatically blow up the sight itself in case the bomber is forced down or crashes on enemy territory . . . R.A.F. engineers want to fit a new twin-engined American fighter with a second seat for a rear gunner . . . The Army Air Corps wants U. S. auto manufacturers to build 8,000 twin-engined bombers and 4,000 four-engined bombers . . . The Navy has 2,235 warplanes on order, still to be delivered . . . Instead of the announced 7,000 new pilots in 1941, the Army is stepping up that figure to 12,000 with a new system of conditioning and training . . . Pan American's Boeing clippers have had their fuel capacity increased, bringing total gallonage per plane to 5,460 . . . A west coast manufacturer recently completed an 80 h.p. radio-controlled plane capable of 150 m.p.h. which will be used for anti-aircraft gunnery practice . . . A new bomber for the British, the Martin *Baltimore*, soon will go into production . . . Three Douglas Army bombers, flying a bombardment mission from their Hawaiian base recently, intercepted an ocean liner 350 miles at sea, "bombed" it and flew home . . . The Lycoming company now is developing a four-cylinder, 100 h.p. air-cooled engine.

* * *

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PATENTS: Low cost. Book and advice free. L. F. Randolph, Dept. 372, Washington, D. C.

PROPELLERS

PROPELLERS for Aircraft, sleds, boats, etc. Propeller repairing, sled blueprints, Hubs face plates, snow sled skis. World's largest propeller catalog. 10c. We have bought the Universal Propeller Co. of St. Louis, Missouri, and will soon offer the approved aircraft propellers formerly manufactured by this company as well as approved repairing of wood aircraft propellers. Banks Propeller Co., Love Field, Dallas, Texas.

MODELS

ONE brown powered comet Zipper Gas Model $20.00. Jack Sheehan, 229 Salem St., Lynnfield, Mass.

REALTY

FLORIDA aviation field for sale. The DeLeon Springs Field, located in one of Florida's beauty spots, on the St. Johns Valley Airway Route, suitable for aeroplanes or Hydroplanes. Also residences and other realty at low prices. F. K. Burt, DeLeon Springs, Florida.

SITUATIONS WANTED

YOUNG man mechanically inclined tools, flying time, desires job as aviator apprentice. Good reference. George Armbrecht, 610 N. 9th St., East St. Louis, Ill.

IMPORTANT! Advertising of licensed used Aircraft only accepted for this section. It is imperative that advertisers mention license number of plane when placing ads.

Plane Tires and Tubes

LAST year rubber tires and inner tubes factories in the United States turned out 30,405 airplane tires and 27,192 airplane inner tubes, a preliminary report recently released by the Bureau of the Census, based on returns from the Census of Manufactures for 1939, reveals. Manufacturers placed a factory value of $544,823 on the tires output and $104,961 on the inner tubes.

During 1939 fewer airplane tires were produced than in 1937. The report shows the 1937 output was 32,710 tires, approximately 2,300 more than the 30,405 made last year. Factories evaluated the 1937 production at $667,985, $120,000 more than the value placed on the 1939 production. While the 1939 output of airplane tires was below that reported in the previous census, the production of inner tubes revealed a slight increase.

In 1937 rubber factories manufactured 25,026 tubes for airplane tires. This was 2,166 fewer tubes than were produced last year. The factory value of 25,026 tubes made in 1937 was estimated at $101,912 by the makers. Airplane tires and tubes, however, represented but a small item comparatively in the total production of tires and tubes during 1937 and 1939, the report discloses. Last year the total output of tires and tubes was valued at $497,636,438. In 1937 the value was $478,770,897. All airplane tires and tubes made in 1939 were valued at $649,784. The production of these items in 1937 equalled $769,897.

FLYING and POPULAR AVIATION USED PLANE LISTING OF AUTHORIZED AIRCRAFT DEALERS

The world's largest selection of used aircraft is listed in this special reader service section. Fine used airplanes in good licensed condition, some with hardly any time at all, many with but a few hours since overhaul. Each plane selected by an expert who has the mark of factory approval due to the fact he is an AUTHORIZED AIRCRAFT DEALER. These are ships you can buy to fly. Select any one of them, they are all real buys, and can be purchased just as you purchase your car.

ALL AIRCRAFT LISTED ARE LICENSED

DEALERS	MODEL AND ENGINE		TIME	OVER-HAULED	PRICE
AERONCA					
J. F. Whickir, Mun. Arpt., Ft. Wayne, Ind ...		Cont.	35 hr.		$1850
East Coast Arwys., W. Hanover, Mass.....	Chief	Cont. 65	290 hr.	new	1700
Leeward Aircraft, New Kensington, Pa	Chief	Cont. 65	65 hr.		1650
Mt. Sts. Avia., 3800 Dahlia St., Denver, Col.	Chief	Cont. 65	260 hr.	60 hr.	1600
S. P. Hale, Jr., 309 F St., Ardmore, Okla	Chief	Cont. 65	200 hr.	10 hr.	1600
Bailey Flyg. Service, Kirksville, Mo.....	Chief	Lyc. 65	80 hr.		1600
J. O. Dockery, Stuttgart, Ark.....	Chief	Lyc. 65	147 hr.		1600
Mt. Sts. Avia., 3800 Dahlia St., Denver, Col.	Chief	Cont. 65	510 hr.	22 hr.	1550
Mt. Sts. Avia., 3800 Dahlia St., Denver, Col.	Chief	Cont. 65	700 hr.	70 hr.	1500
Mt. Sts. Avia., 3800 Dahlia St., Denver, Col.	Chief	Cont. 65	900 hr.	56 hr.	1500
G. E. Verhostra, 2010 Hollywood, S.Bend, Ind.	Chief	Lyc.Dual65	114 hr.	demon.	1500
Jacksonville Air Serv., Jacksonville, Fla	Chief	Cont. 65	275 hr.	35 hr.	1500
East Coast Arwys., W. Hanover, Mass.....	Tandem	Frnklin. 60	165 hr.	new	1500
Cincinnati Aircraft Ser., Cincinnati, O.....		Lyc.	160 hr.		1500
D. Rohn, 1300 Monroe, Beardstown, Ill.....	Chief '40		300 hr.		1485
Baker-Eberle Avia., City Arpt., Detroit, Mich.	Chief 39	Cont. 65	100 hr.	Not rec.	1450
W. Arnet Speer, 3330 Barnet Ave., San Diego, Cal.....	Tandem Tr.	Frnklin. 60	162 hr.	new	1450
E. Porter, Chagrin Arpt., Willoughby, O....	Chief	Cont. 45	350 hr.		1450
Florida Aero & Supply, Orlando, Fla.....		Cont. 65	373 hr.	60 hr.	1450
Bailey Flyg. Service, Kirksville, Mo.....	Chief	Lyc. 65	250 hr.		1450
Bob Wight, Box 487, Biloxi, Miss.....	Trainer	Lyc. 65	38 hr.		1400
C. W. Peterson, Peterson Flyg. Serv., Salem, Mass.....	Chief	Cont. 65	270 hr.		1400
Leeward Aircraft, New Kensington, Pa	Trainer	Lyc. 65	15 hr.		1395
Geo. T. Webb, Oneida, Tenn.....	Chief	Lyc. 65	240 hr.		1375
Cincinnati Aircraft Serv., Cincinnati, O.....		Lyc.	455 hr.		1350
Hass-Hillyard Flyg. Serv., Municipal Arpt., Evansville, Ind.....		Lyc. 65	500 hr.	100 hr.	1350
Tred Avon Flyg. Serv., Inc., Easton, Md.....	Chief	Lyc. 55	465 hr.	none	1350
Huron Flyg. Serv., Box 415, Huron, S. D....	C-65	Cont. 65	700 hr.	5/15/40	1300
Frantz Flyg. Serv., Box 2504, Roanoke, Va .	39	Cont. 65	1050 hr.	500 hr.	1300
G&R Air Serv., Alexandria, Va.....	65-C	Cont. 65	289 hr.	yes	1300
Jos. R. Higgins, Mozart Pk., Wheeling, W.Va.	Low Wing	Warner 90	800 hr.	90 hr.	1295
Portland Flyg. Serv., Portland, Me.....	Chief	Lyc. 55	410 hr.	360 hr.	1295
A. B. Smith, 113 E. Commerce, Aberdeen, Md.	Chief	Cont. A-50	245 hr.	May '40	1295
Warsaw Air Service, Warsaw, Ind.....	1939	Lyc. 50	560 hr.	400 hr.	1295
Frontier Flyg. Serv., Int'l Falls, Minn.....		LeBlond 90	258 hr.	17 hr.	1275
Consol. School Aviation, E. St. Louis, Ill.....		Cont. 50	270 hr.		1275
Aeronca Sales, Munic. Arpt., Ft. Worth, Texas	Chief	Cont. 50	425 hr.	50 hr.	1250
Aeronca Sales, Munic. Arpt., Ft. Worth, Texas	Chief	Cont. 50	457 hr.	200 hr.	1250
J. A. Atherton, Rochester Arpt., Rochester, Minn.....	Trainer	Frank. 60	75 hr.		1250
Chic. Avia. Corp., Palwaukee Arpt., Mt. Prospect, Ill.....	65-LA	Lyc. 65	700 hr.	None since	1245
Leeward Aircraft, New Kensington, Pa	Chief	Cont. 50	135 hr.	5 hr.	1245
G.E. Verhostra, 2010 Hollywood, S. Bend, Ind.	Tandem Tr.	Lyc. 65	40 hr.	demon.	1225
Aeronca Sales, Mun. Arpt., Ft. Worth, Texas.	Chief	Cont. 50	185 hr.		1200
Tred Avon Flyg. Serv., Easton, Md.....	Trainer	Lyc. 55	360 hr.	260 hr.	1200
Susquehanna Air Ser., Montoursville, Pa	Chief	Cont. 65	450 hr.	no	1200
Lenhart Flyg. Ser., Munic. Arpt., Marion, Ind.	Trainer	Frank. 60	90 hr.		1195
Lenhart Flyg. Ser., Munic. Arpt., Marion, Ind.	Chief	Lyc. 65	350 hr.	10 hr.	1195
A. R. Currey, 452 Jefferson, Galesburg, Ill..	Chief	Cont. 50	400 hr.	none	1195
H. S. Smith, 422 S. Union St., Warsaw, Ind..	KC	Lyc. 50	567 hr.	topped	1175
J. F. Whickir, Mun. Arpt., Ft. Wayne, Ind ...		Cont. 65	587 hr.	15 hr.	1150
S.E. Kansas Aircraft Serv., Chanute, Kan....		Frank. 50	746 hr.	327 hr.	1100
Allied Aircraft Sales, Davenport, Ia.....		Lyc. 55	746 hr.	327 hr.	1100
Aero Ways Inc., Cleveland, Ohio.....		Cont. 50	127 hr.		1050
Queen City Flyg. Serv., Cincinnati, Ohio....		Cont. 50	663 hr.		1050
H. G. Mayes, Huntington, W. Va.....		Cont. 50	788 hr.	38 hr.	1050
Rome Boekenhoff, Jr., 626 Maine, Quincy, Ill.	Trainer	Frank. 60	80 hr.		1050
Cincinnati Aircraft, Cincinnati, Ohio.....		Frank.	563 hr.		1025
Chas. Roberts, Mun. Arpt., Dothan, Ala.....		Cant. 50	375 hr.		1000
O. E. Dickerhoof, Mun. Arpt., Chanute, Kan.		Frank.	457 hr.	400 hr.	1000
Virginia Air Serv., Gordonsville, Va.....	Chief	Lyc. 50	700 hr.	May '40	985
Southern Airways Sales Co., Munic. Arpt., Birmingham, Ala.....		Cont. 50	175 hr.	9/1/40	950
Portland Flyg. Serv., Portland, Me.....		Menas. 50	425 hr.	none	875
Florida Aero & Supply, Orlando, Fla.....		Aero. 40	82 hr.		795
Ryan Air Service, Decorah, Ia.....		Aero. 45	318 hr.		795
A. B. Smith, 113 E. Commerce, Aberdeen, Md.	K	Aero. E	850 hr.	30 hr.	775
Pierce Flyg. Serv., 2135 Broadway, Eureka, Cal.....	KC	Cont. 40	580 hr.	10 hr.	765
G. E. Verhostra, 2010 Hollywood, South Bend, Ind.....	K	Aeron. 40	225 hr.	yes	750
Buroker-Hicks Flyg. Serv., Olympia, Wash..	K	Aero. 40	400 hr.		700
Mississippi Arwys., Jackson, Miss.....		Aeronca	406 hr.	Nov. '39	675
Youngstown Arwys., Youngstown, Ohio	K	Aero. 37	300 hr.		675
Lane Air Serv., Mun. Arpt., Albany, Ga.....	K	Aero. 42	450 hr.	50 hr.	675
Hylan Flyg. Serv., Arpt., Rochester, N.Y.....		Aero. 40	300 hr.	300 hr.	650
Jenkins Air Serv., Rochester, N.Y.....		Aero. 40	400 hr.		650

DEALERS	MODEL AND ENGINE		TIME	OVER-HAULED	PRICE
Oakland Aircraft Corp., Alameda, Cal.....	K	Aero. 40	730 hr.	Oct. '39	650
Pioneer Air Serv., Romulus, Mich.....	K	Aero. 40	482 hr.	9 hr.	600
Daitz Flyg. Corp., Roosevelt, Mineola, L.I ...	K	Aero. 37	539 hr.	74 hr.	600
W.Va. Air Serv., Box 401, Clarksburg, W.Va.	K	Aeron. 40	500 hr.	just	595
Philip A. Meinke, Route 3, Willoughby, Ohio.	C-3	Aero. 36		5 hr. ago	575
East Coast Arwys., W. Hanover, Mass.....	K	Aeronca 36	570 hr.	130 hr.	550
Perkiomen Valley Arpt., Collegeville, Pa....	K	Aeronca 40	200 hr.	no	550
Schuylkill Arpt., Orweigsburg, Pa.....	C 3	Aeronca 36	393 hr.	July '40	550
Morley Airplane Co., Madison, Wisc.....		Aeronca	250 hr.		550
Oscar L. Hostetter, York Arpt., Thomasville, Pa.	K	Aeronca 40	750 hr.	100 hr.	525
A. R. Currey, 452 Jefferson, Galesburg, Il..	C-3	Aeron. 37	1000 hr.	recently	525
A. R. Smith, 113 E. Commerce, Aberdeen, Md.	C-3	Aero. E	750 hr.	Oct. '39	505
A. R. Currey, 452 Jefferson, Galesburg, Ill..	C-3	Aeron. 37		just	500
AMERICAN EAGLE					
Valley Flyg. Serv., Rt. 4, Bx. 132, Visalia, Cal.		Kinner 100	700 hr.	25 hr.	550
Lenhart Fly. Serv., Munic. Arpt., Marion, Ind.		Kinner K5	1090 hr.	just	550
ARROW SPORT					
E. R. Elliott, Elliott Motors, Coeur d'Alene, Idaho		Ford V-8	195 hr.		850
Hobley-Maynard Air Serv., New Orleans Arpt., New Orleans, La.....	Ford 85		400 hr.	20 hr.	750
Blvd. Arpt., Roosevelt Blvd. & Red Lion Rd., Phila., Pa.....	Model F	V-8 82 hp.	500 hr.	90 hr.	500
BEECH					
Harry A. Hammill, Box 992, Austin, Texas ..	D-17-S	Wasp 450	532 hr.		8500
Harry A. Hammill, Box 992, Austin, Texas ..	D-17-R	Wright 450	900 hr.	700 hr.	8000
Hass-Hillyard Fly. Serv. Mun. Arpt. Evansville, Ind.....	B-17 E	Wright 285	1100 hr.	75 hr.	4000
BELLANCA					
Art Whitaker, Portland Arpt., Portland, Ore.	Cruisair	Ken-Royce 90	90 hr	none	3500
BIRD					
Red Bank Arpt. Inc., Red Bank, N. J.....	Crusair	LeBlond 90	280 hr.	never	3000
Lenhart Fly. Ser., Mun. Arpt., Marion, Ind....		Kinner B5	610 hr.	600 hr.	1195
BOEING					
J. O. Dockery, Stuttgart, Ark.....	Duster	Hornet 600	1296 hr.	1175 hr.	2500
CESSNA					
Wallace Aircraft Co., Clarcona, Florida....		Warner 165	50 hr.	new	7995
R. G. Howard, Deposit Bank Bldg., DuBois, Pa.	37	Warner 145	450 hr.	405 hr.	3450
Strickland-Horner Air Serv., Arpt., Alva, Okla.	C34	Warner 145	682 hr.	none	2850
Aero Service Inc., McKinley Arpt., Canton, Ohio.....	4PCLM	Wright J-6-7	425 hr.	130 hr.	1150
John Ruzuka, Circus City Arpt., Peru, Ind....	A.W.	Warner 125	800 hr.	100 hr.	850
COMMANDAIRE					
J. L. Schroeder, Rt. 3, Box 117, Houston, Tex.		Chall. 185	500 hr.	none	800
Charles Ferris, Hillside, Ill.....		Warner 125	410 hr.	170 hr.	525
CURTISS ROBIN					
Toomey, Gatleff & Webb, Knoxville, Tenn..		Wright 165	575 hr.	170 hr.	1400
Leeward Aircraft, New Kensington, Pa.....		Chall. 185	512 hr.	17 hr.	885
Geo. Roper, 27 S. State, Salt Lake City, U..		Challenger	800 hr.	Mar. '40	800
Regan Flyg. Serv., Shawnee, Okla.....	J65		300 hr.	50 hr.	795
H.L.Peterson, W'mson-J'ns'n Arpt., Duluth, Mn.		Curtiss Chall.	442 hr.	190 hr.	750
Al Leeward, New Kensington, Pa.....		Challenger 185	500 hr.	110 hr.	745
A. A. Goldsmith, Nashua, N H.....		Wright J65	700 hr.	150 hr.	700
North West Jersey Air Serv., Clinton, N. J...		Chall. 185	550 hr.		675
R. A. Miller, North Benton, Ohio.....		Chall. 185	444 hr.	380 hr.	550
H. W. Haver, Lebanon, N. J.....	3 pass.	Chall. 185	600 hr.	just	500
DART					
Brayton Fly. Sv., Lambert Arpt., Robertson, Mo.		Ken-Royce	250 hr.	200 hr.	2975
Ashcraft Bros. Flyg. Serv., Lawrence, Kans...		LeBlond	370 hr.	325 hr.	2250
Port Columbus Flyg. Serv., Port Columbus, O.	G	Lambert	941 hr.	160 hr	1600
EAGLEROCK					
Thompson Flyg. Serv., Salt Lake City, Utah..		Wright J5	1049 hr.	149 hr.	1000
J. O. Dockery, Stuttgart, Ark.....		Hisso 180	800 hr.	70 hr.	550
FAIRCHILD					
Carolina Aircraft Sales, Mun. Arpt., Charlotte, N. C.....	24	Warner 145	130 hr.	new	5500
Wallace Aircraft Co., Clarcona, Fla.....	24	Warner 145	350 hr.		4500
McBoyle Cub Sales, Arpt., Lake Delton, Wis.	24	Warner 145	140 hr.		4500
T. A. Colbertson, Medford, Oregon.....	246	Warner 145	800 hr.	350 hr.	3500
Red Bank Airport, Inc., Red Bank, N. J.....	24	Ranger 150	995 hr.	being	2595
Leech Aircraft, Roosevelt Fld., Mineola, N. Y.		Ranger 145	959 hr.	245 hr.	2600
Somerset Hills Arpt., Basking Ridge, N. J....	24	Warner 145	490 hr.	425 hr.	2400

FLYING and POPULAR AVIATION USED PLANE LISTING OF

DEALERS	MODEL	ENGINE	TIME	OVER-HAULED	PRICE
Nell McCray Arprt., Jamestown, N. Y.		Ranger	480 hr.	350 hr.	2350
Inter City Airlines, Boston Mun. Arpt., East Boston, Mass.	24	Ranger 145	550 hr.	150 hr.	2250
California Aircraft Corp., Van Nuys, Cal.	24	Warner 145	400 hr.	none	2250
Schneider Aero Serv., Fresno, Calif.		Warner 145	954 hr.	206 hr.	2150
West Coast Aircraft, Inglewood, Calif.	24	Warner 145	755 hr.	227 hr.	2150
Chicago Avia. Corp., Curtiss Arpt., Glenview, Ill.	24	Warner 125	520 hr.	100 hr.	1595
Walz Corp. Central Arpt., Camden, N. J.	22	Cirrus 95	973 hr.	210 hr.	1450
Harrisburg Air Serv., Harrisburg, Pa.		Wright	800 hr.	200 hr.	1100
Harrisburg Air Serv., Penn-Harris Arpt., Harrisburg, Pa.	KR-34	Wright J65-175	1193 hr.	1143 hr.	900
Piedmont Avia. Mun. Arpt., Winston-Salem, N. C.	KR-34	Writght 165	642 hr.	386 hr.	875
A. Whitaker, Swan Is. Arpt., Portland, Ore.	24	Cirrus	895 hr.	50 hr.	850
FLEET					
Lynch. Air Tran. & Sale, Preston Glenn, Lyn, Va.	9	Kinner 125	900 hr.	150 hr.	3000
Lync. Air Tran. & Sale, Preston Glenn, Lyn, Va.	7	Kinner 125	800 hr.	200 hr.	2400
H. A. Hammill, Box 992, Austin, Texas.		Warner 125	700 hr.	35 hr.	1500
Ong Aircraft Corp., P.O. Box 214, Kansas City, Mo.	"2"	Kinner 100	2250 hr.	2206 hr.	1250
FUNK					
Bailey Fly. Ser., Box 346, Corning, N. Y.	Model E	Funk 75	175 hr.	no	1400
GREAT LAKES					
Racine Fly. Serv., Arpt., Racine, Wisc.		Cirrus 100	328 hr.	topped	900
P. A. Meinke, Route 3, Willo, Ohio.	2TIA	Cirrus 90	950 hr.	100 hr.	650
HAMMOND					
Perkiomen Valley Arpt., Collegeville, Pa.	Model Y	Menasco 150	180 hr.	just	3200
Burlington Airplane Co., Burlington, Ia.	K5.	Kinner			650
KINNER					
Freder. Air Ser., Box 147, Nott. Fld., Fre., Va.	Sport wing	Kinner B5	900 hr.	200 hr.	1550
California Aircraft, Van Nuys, Calif.	K-5	Kinner 100	1000 hr.	none	1350
Pac. Dis. Corp., 1321 Flower St., Glen., Calif.	Bird K5	Kinner 100	937 hr.	350 hr.	1000
Pac. Dis. Corp., 1321 Flower St., Glen., Calif.	Sport K5	Kinner 100	1375 hr.	675 hr.	1000
KINNER SPORTWING					
Schneider Aero. Serv., Fresno, Calif.		B-5 125	1335 hr.	506 hr.	1350
Louisville Flyg. Serv., Inc., Louisville, Ky.		Kinner K-5	460 hr.		945
LAIRD					
J. O. Dockery, Stuttgart, Ark.		J-5-220	845 hr.	825 hr.	1750
Johannesson Fly. Ser., Stevens. Arpt., Winn., Can.	LC200	Wright J5-220	1250 hr.	50 hr.	950
LINCOLN					
Peoria Aero Sales Co., 342 Knoxville Ave., Peoria, Ill.	AP	Kinner 125	400 hr.	50 hr.	795
Fox Valley Flyg. Serv., Aurora, Ill.		Kinner	1468 hr.	150 hr.	500
LOCKHEED VEGA					
H. A. Hammill, Box 992, Austin, Texas.		Wasp		15 hr.	5000
LUSCOMBE					
Falcon Aircraft, L. A. Mun. Arpt., Inglewood, Cal.	Phantom	Warner 145	new		4000
C. Evers, 247 Park Avenue, N.Y.C.	Seaplane	Cont. 85	23 hr.		3200
Red Bank Arpt., Inc., Red Bank, N. J.	Silvaire	Cont. 75	40 hr.	never	2700
C. Evers, 247 Park Avenue, N.Y.C.	Seaplane	Cont. 85	80 hr.		2300
H. S. Smith, 422 S. Union St., Warsaw, Ind.	8A	Lyc. 65	45 hr.		2150
R. C. Davis, 328 N. Adams St., Glendale, Cal.	8A	Cont. 65	135 hr.	none	2000
Red Bank Arpt., Inc., Red Bank, N. J.	8A	Cont. 65	435 hr.	never	1900
Aircraft Asso. Munic. Arpt., Long Beach, Cal.		Cont. 65	115 hr.		1900
Cape Aircraft, Inc., Falmouth Arpt., Hatch, Mass.	8A-1940	Cont. 85	390 hr.	390 hr.	1895
D. Schall, 33 Claggett Rd., Hyattsville, Md.	8-B	Lyc. 85	35 hr.	new	1895
Massey & Ransom Flyg. Serv., Denver, Colo.		Cont. 85	335 hr.		1875
Jersey Fly. Serv. No. J Arpt., Oak., N. J.		Cont. 65	75 hr.	none	1800
C. Evers, 247 Park Avenue, N.Y.C.	Landplane	Cont. 65	85 hr.		1800
Midwest Av. Sales, Stinson Arpt., LaGrange, Ill.		Lyc. 65	125 hr.		1800
Walz Corp., Central Arpt., Camden, N. J.		Cont. 85	200 hr.	none	1785
Ia. Airplane Co., Mun. Arpt., Des Moines, Ia.		Cont. 65	350 hr.	350 hr.	1750
Page Airways, Inc., Rochester, N. Y.		Cont. 65	200 hr.	none	1750
Massey & Ransom Flyg. Serv., Denver, Colo.		Cont. 65	350 hr.	60 hr.	1725
Ia. Airplane Co., Mun. Arpt., Des Moines, Ia.		Cont. 65	400 hr.	400 hr.	1700
Sioux Skyways, Inc., Mun. Arpt., Sioux Falls, S. D.	8B	Lyco. 65	250 hr.		1675
J. L. Wells, 106 W. Main, Avon Park, Fla.	8A	Cont. 65	95 hr.	none	1675
W. F. Luke, Schenectady, N. Y.		Cont. 65	100 hr.		1657
A. E. Padags, 340 Park St., Wis. Rap., Wis.	8A	Cont. 65	455 hr.	55 hr.	1650
Iowa Airplane Co., Des Moines, Iowa.	8A	Cont. 85	590 hr.		1650
Massey & Ransom Flyg. Serv., Denver, Colo.		Cont. 65	490 hr.		1650
Consol. Sch. Avia., E. St. Louis, Ill.		Cont. 65	180 hr.		1650
A. E. Padags, 340 Park St., Wis. Rap., Wis.	8B	Lyco. 85	275 hr.	none	1550
Island Crop Dusting Co., Caribou, Maine	8A	Cont. 65	400 hr.	300 hr.	1550
Red Bank Arpt., Inc., Red Bank, N. J.	8A	Cont. 65	795 hr.	250 hr.	1500
Sundorph Aero Corp., Cleveland, Arpt., O.		Cont. 50	65 hr.	none	1500
Sharon Air Ser., 347 Vernon Ct., Sharon, Pa.		Cont. 50	250 hr.	just	1450
Hudson Valley Aircraft, Middletown, N. Y.		Cont. 65	60 hr.		1450
Walz Corp., Central Arpt., Camden, N. J.		Cont. 50	235 hr.	none	1375
A. E. Padags, 340 Park St., Wis. Rap., Wis.	8	Cont. 55	450 hr.	none	1350
Queen City Flyg. Serv., Cincinnati, Ohio.		Cont. 50	469 eng. 402 ship.		1250
Arents Air Ser., Armonk, N. Y.	8	Cont. 50	200 hr.	200 hr.	1200
MONOCOACH					
Carnahan Flyg. Serv., Arpt., Bloomington, Ill.		Wright	998 hr.	165 hr.	995
Dewey Eldred Fly. Ser., Last Nation Rd., Willoughby, Ohio.		Wright J67			600
MONOCOUPE					
B. Belt, 1114 Boundary, Red Oak, Ia.	90-A	Lamb. 90	450 hr.	350 hr.	1850
N. R. McCray, Jamestown, N. Y.		Lambert 90	375 hr.	300 hr.	1750
Arents Air Serv., Armonk, N. Y.	90A	Lambert 90	400 hr.	225 hr.	1700
Al Gillis Fly. Ser., 125 1st Ave., N. Gr. F., Mass.	90A	Lamb. 90	550 hr.	190 hr.	1700
Cape Air., Inc., Falmouth Arpt., Hatch., Mass.	90A	Lamb. 90	350 hr.	motor just majored	1600
Bennett Air Ser., P.O. Box 247, Higt., N. J.	6W-33	War-Scar 125	1450 hr.	1380 hr.	1250
Chi. Avi. Corp., Curtiss Arpt., Glen., Ill.	90	Lamb. 90	490 hr.	70 hr.	1195
Aero Ser., Inc., McKin. Arpt., Canton, Ohio.		War-Scar 125	750 hr.	80 hr.	1150
Inter City Air., Bost. Mun. Arpt., E. Bos., Mass.		Lamb. 90	620 hr.	240 hr.	995
Oakland Aircraft, Alameda, Cal.		Lamb. 90	688 hr.	Feb. '39	850
NICHOLAS-BEAZLEY					
Sedalia Fly. Serv., 103 N. Ohio, Sedalia, Mo.	8	Genet	360 hr.	300 hr.	525
Dubuque Airways, Dubuque, Iowa.		Genet 80	400 hr.	60 hr.	525
PIPER CUB					
Odessa Flyg. Serv., Odessa, Texas.	J-4A	Cont.	110 hr.	none	2150
J. A. Field, 17 Forman St., Brad., Pa.	J-4	Cont. 65 Dual	10 hr.	no	1950
L-H Air Serv., P.O. Box 93, Hatboro, Pa.	Cub Coupe	Cont. 65	150 hr.	no	1900
W. Blood Aircraft Sales, Charleston, W. Va.	J-4	Cont. 65	75 hr.	new	1900
Stiles Motor Co., 260 Main St., North, N. Y.	J4A Coupe	Cont. 65	75 hr.	new	1900
Piedmont Avi., Inc., Mun. Arpt., W-S, N. C.	Coupe	Cont. 65	125 hr.	none	1875
McBoyle Cub Sales, Arpt., Lake Delton, Wisc.	Coupe	Cont. 65	75 hr.	new	1850
Sedalia Fly. Serv., 103 N. Ohio, Sedalia, Mo.	Cruiser	Cont. 75	60 hr.		1800
Susquehanna Air Ser., Montoursville, Pa.	J5	Lyc. 65	29 hr.		1795
Hangar Six, Inc., Stinson Fld., San An., Tex.	J-4	Cont. 65	310 hr.		1775
Strickland-Horner Air Serv., Arpt., Alva, Okla.	Cub J4	Cont. 65	130 hr.	top	1700
Air City Fly. Ser., 5500 E. 3d St., Dayton, O.	J5 Cruiser	Cont. 75	50 hr.		1695
Skelly Fly. Serv., Arpt., Greenville, Penna.	Coupe J4	Cont. 65	85 hr.	new	1695
W. B. Skelton, Greenville Arpt., Green., Pa.	J4 Coupe	Cont. 65	80 hr.	new	1675
Al Young, Somerset Pike, Johnstown, Pa.	Cruiser	Cont. 75	113 hr.		1675
Wright Fly. Serv., Scott Arpt., Martins Ferry, O.	Coupe '40	Cont. 65	330 hr.	10	1675
Bethany Air Serv., Inc., Bethany, Conn.		Cont.	78 hr.		1650
Hudson Valley Aircraft, Middletown, N. Y.		Cont. 65	28 hr.		1650
Wenatchee Air Ser., Rt. 4, Wena., Wash.	Coupe	Cont. 65	255 hr.		1600
J. A. Field, 17 Forman St., Brad., Pa.	J-4	Cont. 65 Dual	80 hr.	no	1600
Krantz Aero Serv., Pt. Erie Arpt., Erie, Pa.	Coupe	Cont. 65	110 hr.	110 hr.	1600
Woodlawn Balto. Co., Baltimore, Md.	Coupe	Cont. 65	153 hr.		1595
Matt. & Rappa, Roosevelt Fld., Min., N. Y.	Coupe	Cont. 65	285 hr.	7-5-40	1575
Clovis Flyg. Serv., Clovis, N. M.		Cont. 85	100 hr.	none	1575
Aviation Ser., Inc., Arpt., Newport News, Va.	J-5	Cont. 75	76 hr.		1575
LD Fly. Ser., Euclid Ave. Arpt., Willo., Ohio.	Coupe	Cont. 65	160 hr.	no	1550
Rocky Mount Fly. Ser., Mun. Airp. R. Mt., N. C.	Coupe J-4	Cont. A 65	130 hr.	none	1550
R. E. Lee, Munic. Arpt., Rocky Mount, N. C.	Coupe J-4	Cont. A 65	120 hr.	no	1550
Southern Air Serv., Memphis, Tenn.		Cont. 65	100 hr.	new	1550
Stiles Motor Co., 260 Main St., North., N. Y.	Coupe J4A	Cont. 65	210 hr.		1500
Art Whitaker, Portland Arpt., Portland, Ore.	Coupe	Cont. 65	365 hr.	365 hr.	1500
Bethany Air Serv., Bethany, Conn.		Cont.	201 hr.		1500
Seidner Fly. Ser., S.A.M. Arpt., Youngs, Ohio	Coupe	Cont. 65	146 hr.	new	1495
Hylan Flyg. Serv., Rochester, N. Y.		Cont. 65	450 hr.	25 hr.	1450
Thomas Met. Toledo Mun. Arpt., Toledo, O.	Cruiser J-5	Cont. 75	180 hr.	never	1425
W. Buel, 102 N. Main, Fremont, Neb.	Coupe	Frank. 60	75 hr.	none	1400
Seidner Fly. Ser., S.A.M. Arpt., Youngs., Ohio	Coupe	Cont. 65	200 hr.	new	1400
W. Va. Air Serv., County Arpt., Clarksburg, W. Va.	J4A	Cont. 65	580 hr.	no	1375
M. F. Warrington, Selbyville, Del.	J3	Cont. A55	25 hr.	20 hr.	1350
Racine Fly. Serv., Arpt., Racine, Wisc.	Coupe '39	Cont. 65	310 hr.	no	1350
Tennessee Aero Corp., Nashville, Tenn.	Coupe	Cont. 50	48 hr.	none	1350
Al Young, Somerset Pike, Johnstown, Pa.	Trainer	Lyc. 65	37 hr.		1300
Ted Brixius, Columbia, Mo.	Coupe	Cont. 50	196 hr.	none	1295
McBoyle Cub Sales, Arpt., Lake Delton, Wisc.	J3	Franklin 60	68 hr.	new	1275
J. Ruzicka, Circus City Arpt., Peru, Ind.	J3 New	Frank. 60	80 hr.	none	1250
W. Arnet Speer, 3330 Barnett, S. Diego, Cal.	J3F	Frank. 50	900 hr.	25 hr.	1250
W. Arnet Speer, 3330 Barnett, S. Diego, Cal.	J3F	Frank. 50	832 hr.		1250
Odessa Flyg. Serv., Odessa, Texas.	J-3	Frank. 50	405 hr.	none	1250
L-H Air Serv., P.O. Box 93, Hatboro, Pa.	J3L-65	Lyc. 65	100 hr.	no	1200
Burlington Airpl. Co., Burlington, Ia.	J3	Frank. 60	60 hr.	new	1200
Barr Aviation Corp., Detroit, Mich.		Cont. 65	230 hr.	none	1200
Northway Flyg. Serv., Columbus, Ohio.	J-4	Frank. 60	350 hr.	yes	1200
Palm Beach Aero Corp., W. Palm Beach, Fla.	Coupe	Cont. 65	122 hr.		1195
Bennett Air Ser., P.O. Box 247, Higt., N. J.	Coupe J4	Cont. 50	166 hr.	166 hr.	1175
Al Young, Somerset Pike, Johnstown, Pa.	Trainer	Franklin 60	312 hr.		1175
Bethany Air Ser., Bethany Arpt., Beth., Conn.	J4	Cont. 50	242 hr.		1150
Va. Cub Dist., Inc., Box 211, Farmv., Va.	Trainer	Lyco. 65	250 hr.		1150
McBoyle Cub Sales, Arpt., Lake Delton, Wisc.	J3	Franklin 50	125 hr.		1150
Maheux's Arpt., Stevens Mill, Auburn, Maine	J2 Seapl.	Cont. 40	346 hr.		1150
Geo. C. Haven, Schenectady, N. Y.		Frank. 50	25 hr.	none	1150
Va. Cub Dist., Inc., Box 211, Farmv., Va.	Trainer	Frank. 60	350 hr.		1100
Art. Whitaker, Portland Arpt., Portland, Ore.	J3	Frank. 50	1000 hr.	1000 hr.	1100

AUTHORIZED AIRCRAFT DEALERS

DEALERS	MODEL AND ENGINE		TIME	OVER-HAULED	PRICE
Wm. T. Anderson, P.O. Box 275, Essex Fells, N. J.	J3F	Frank. 60	400 hr.	yes	1100
G. L. Williams, Syracuse Arpt., Syra., N. Y.	J3F-60	Frank. 60	825 hr.	735 hr.	1100
Sedalia Fly. Serv., 103 N. Ohio, Sedalia, Mo.	J3	Frank. 60	365 hr.	350 hr.	1100
Odessa Flyg. Serv., Odessa, Texas	J-3	Frank. 50	864 hr.	169 hr.	1100
Hood Aircraft Sales Co., Northampton, Mass.	J3	Cont. 50	165 hr.		1100
Aviation Ser., Inc., Arpt., Newport News, Va.	J3	Lyc. 55	114 hr.		1100
Oscar L. Hostetter, York Arpt., Thomasv., Pa.	Coupe	Cont. 65	375 hr.		1075
Strickland-Horner Air Serv., Alva, Okla.	J3L	Lyc. 50	520 hr.	just	1075
W. Va. Air Serv., Box 401, Clarksburg, W.Va.	J3F	Frank. 50	160 hr.		1075
West Coast Aircraft, Inglewood, Calif.	J-3	Cont. 50	1250 hr.	none	1075
B. F. Hines, Mex.-Tex. Arpt., Hobbs, N. M.		Frank.	350 hr.	50 hr.	1075
Al Gillis Fly. Ser., 125 1st Ave. N., G. F., Mont.	J3	Frank. 50	170 hr.	none	1050
Wenatchee Air Ser., Rt. 4, Wena., Wash.	J3	Cont. 50	575 hr.	30 hr.	1050
Jersey Fly. Ser., N. Jersey Arpt., Oakl., N. J.	J3	Frank. 60	300 hr.	75 hr.	1050
L. Berry, Selman Field, Monroe, La.	Sport J3	Cont. 50	600 hr.	none	1050
Strickland-Horner Air Serv., Arpt., Alva., Okla.	J3F	Frank.	300 hr.	top	1050
Martin & Phipps, 619 W. 7th St., Sioux City, Ia.	J3	Lyc. 55	400 hr.	none	1050
Burlington Airpl. Co., Burlington, Ia.	J3	Lyc. 50	400 hr.	new	1050
Carolina Aircraft Sales, Mun. Arpt., Charlotte, N. C.	J4	Cont. 65D	340 hr.	325 hr.	1050
Air City Fly. Ser., 5500 E. Third St., Day., O.	J3	Frank. 50	386 hr.	brakes and compass	1045
Rannells Air Ser., Arpt., Cumberland, Md.	J3	Frank. 60	500 hr.	no	1000
Valley Fly. Serv., Rt. 4, Box 132, Visalia, Cal.	J3F	Frank. 50	1100 hr.	10/40	1000
Hawthorne Fly. Serv., Munic. Arpt., Charleston, S. C.		Frank. 60	300 hr.	none	1000
Pekrul's Fly. Serv., Arpt., Traverse City, Mich.	J3	Frank. 50	890 hr.	200 hr.	1000
Page Airways, Inc., Rochester, N. Y.		Lyc. 50	450 hr.	none	1000
Utah Pacific Airways, Inc., Ogden, Utah.		Lyc. 55	575 hr.	575 hr.	1000
L. Dethloff, Airport, Willoughby, Ohio.	J-3	Frank.	572 hr.	none	1000
North-West Jersey Air Serv., Clinton, N. J.	J-3	Lyc. 50	165 hr.		1000
Speed's Flyg. Serv., Jackson Hts., N. Y.	J-3	Cont. 50	650 hr.	30 hr.	1000
Aviation Ser., Arpt., Newport News, Va.	J3	Lyc. 50	449 hr.		1000
Leo Carr, Box 134, Charleston, Mo.	Trainer	Frank. 50	200 hr.	no	1000
Aviation Ser. Arpt., Newport News, Va.	J3	Lyc. 50	761 hr.	157 hr.	1000
Air City Fly. Ser., 5500 E. Third St., Day., O.	J3	Frank. 50		recent	995
L. Berry, Selman Field, Monroe, La.	Trainer J3	Lyc. 50	1100 hr.	none	995
Lexington Flyg. Serv., Lexington, Ky.		Frank.	180 hr.	none	995
Lane Avia. Corp., Cleveland Arpt., Cleve., O.	Coupe	Cont. 50	150 hr.	no	975
Lexington Flyg. Serv., Lexington, Ky.		Lyc.	560 hr.	none	975
Consol. School Aviation, E. St. Louis, Ill.		Frank. 50	300 hr.		975
Aviation Ser., Inc., Arpt., Newport News, Va.	J3	Lyc. 50	562 hr.		975
Tennessee Aero Corp., Nashville, Tenn.		Frank. 50	250 hr.		970
Bennett Air Ser., P.O. Box 247, Higt., N. J.	Trainer J3	Frank. 50	331 hr.	331 hr.	950
Ben. A. Funk, Grover, Mo., Hy. 50		Frank. 50	550 hr.	250 hr.	950
Ray Wilson, Inc., Park Hill Arpt., Den., Colo.	J3F	Frank. 50			950
Skelly's Fly. Serv., Arpt., Greenville, Pa.	Trainer	Lyc. 50	550 hr.	no	950
Clinton Arpt., Elliott Fly. Serv., DeWitt, Ia.	J3	Frank. 50	550 hr.		950
Airways, Inc., Waterville, Me.		Frank. 50	240 hr.		950
Mississippi Airways, Jackson, Miss.		Cont. 50	615 hr.	May '40	950
Frost Air Serv., W. Haven, Conn.		Cont. 50	290 hr.	none	950
Northway Flyg. Serv., Columbus, Ohio.	J-3	Cont. 50	325 hr.		950
Northway Flyg. Serv., Columbus, Ohio.	J-3	Frank. 50	380 hr.		950
Hood Aircraft Sales Co., Northampton, Mass.	J3	Cont. 50	370 hr.	70 hr.	950
Schuylkill Arpt., Orweigsburg, Pa.	J4	Cont. 55	200 hr.	Aug. '40	950
Harrisburg Air Ser., Penn.-Harris. Arpt., Harrisburg, Pa.	J3L	Lyco. 55	910 hr.	825 hr.	950
Va. Cub Dist., Inc., Box 211, Farmville, Va.	Trainer	Lyco. 50	400 hr.		950
Rocky Mt. Fly. Ser., Mun. Arpt., Rocky Mt., N. C.	J3	Frank. 55	400 hr.	none	950
L-D Fly. Ser., Euclid Ave. Arpt., Willo., Ohio.	J3-50	Frank. 50	650 hr.	no	950
Ellis E. Eno, Eno Arpt., Ft. Dodge, Iowa	J3C-50	Cont. 50	550 hr.	200 hr.	925
Hawthorne Fly. Serv., Munic. Arpt., Charleston, S. C.		Frank. 60	750 hr.	100 hr.	900
Ray Wilson, Inc., Park Hill Arpt., Den., Colo.	J3F	Frank. 50			900
Va. Cub Dis., Inc., Box 211, Farmville, Va.	Trainer	Frank. 50	800 hr.	700 hr.	900
Strickland-Horner Air Serv., Arpt., Alva, Okla.	J3-39	Cont. Dual 50	660 hr.	top	900
Bethany Air Serv., Bethany, Conn.		Lyc.	510 hr.	110 hr.	900
Southern Air Serv., Memphis, Tenn.		Lyc. 50	300 hr.	new	900
Utah Pacific Airways, Inc., Ogden, Utah.		Cont. 50	500 hr.	25 hr.	900
Susquehanna Air Ser., Montoursville, Pa.	J3	Lyc. 55	1050 hr.	450 hr.	895
J. C. Gendron, Ironwood, Mich.	Sport J3	Frank. 50	325 hr.	50 hr.	895
Northway Flying Serv., Columbus, Ohio.	J-3	Frank. 50	650 hr.		880
L. Berry, Selman Field, Monroe, La.	J3	Frank. 50	800 hr.	75 hr.	875
Skelly's Fly. Serv., Arpt., Greenville, Pa.	Trainer	Lyc. 50	800 hr.	no	875
Ranger Flyg. Serv., Ranger, Texas.	J3F	Frank. 50	775 hr.	July '40	825
Ranger Flyg. Serv., Ranger, Texas.	J3F	Frank. 50	1000 hr.	Apr. '40	800
Ranger Flyg. Serv., Ranger, Texas.	J3F	Frank. 50	775 hr.	May '40	800
Schuylkill Arpt. Co. Orweigsburg, Pa.	J3F	Frank. 50	700 hr.	Mar. '40	800
W. B. Skelton, Greenv. Arpt., Greenv., Pa.	J3	Lyco. 50	900 hr.	10-1-40	795
L. H. Melter, Solon Arpt., Solon, Ohio.	J3	Cont. A40	350 hr.	300 hr.	795
T. Metcalf, Toledo Munic. Arpt., Toledo, Ohio	J3F	Frank. 50	1170 hr.	220 hr.	775
Wright Fly. Serv., Scott Arpt., Martins Ferry, O.	J3	Lyc. 50	840 hr.	240 hr.	775
Jenkins Air Serv., Rochester, N. Y.		Cont. 40	450 hr.	25 hr.	775
Martin & Phipps, 619 W. 7th St., Sioux City, Ia.	J2	Cont. A40	400 hr.	recently	765
Akron Airw., Inc., Arpt., Akron, Ohio.		Cont. 50	320 hr.		750
Bennett Air Ser., P.O. Box 247, Higts., N. J.	J3	Frank. 50	702 hr.	702 hr.	750
Zimmerly Bros., Lewiston, Idaho	J-3	Cont. 40	1335 hr.	1242 hr.	750
United Flyers, Inc., Ridgewood, N. J.	J-3	Cont. 40	200 hr.		750
Ranger Flyg. Serv., Ranger, Texas.	J3F	Frank. 50	1100 hr.	Jan. '40	750
H. S. Smith, 422 S. Union St., Warsaw, Ind.	J3	Cont. 40	376 hr.	40 hr.	750
Burlington Airplane Co., Burlington, Ia.	J2	Cont. A40	650 hr.		750
J. A. Field, 17 Forman St., Brad., Pa.	J3C40	Cont. 40	350 hr.	yes	725
C. R. Galloway, 3006 Hardi, Ft. Smith, Ark.	sport	Cont. 40	450 hr.	recent	700
Piedmont Avi., Muni. Airp., W-S., N. C.	J3	Cont. A40	478 hr.	33 hr.	700
L. E. Smith, Sterling, Colo.	J3 Sport	Cont. 40	325 hr.	just	700
Hudson Valley Aircraft, Middletown, N. Y.		Cont. 40	300 hr.		700
Woodlawn Balto Co., Baltimore, Md.	J-3	Cont. 40	376 hr.	120 hr.	695
Hood Aircraft Sales Co., Northampton, Mass.	J2	Cont. 40	400 hr.	19 hr.	695
Hood Aircraft Sales Co., Northampton, Mass.	J2	Cont. 40	600 hr.		695
Allstate Airways, Newton Rd., Haverhill, Mass.		Cont. A-40	600 hr.	100 hr.	675
Calkins Arcft., 1022 N. Atlantic, Seattle, Wash.		Cont. 40	800 hr.	17 hr.	675
Oakland Arcft., Alameda, Cal.	J-2	Cont. 40	1785 hr.	May '40	665
Blvd. Arpt., Inc., Roosevelt Blvd., Phil., Pa.	J2	Cont. 40	250 hr.	no	650
Jesse Jones, Munic. Arpt., Lancaster, Pa.	J2	Cont. 40	250 hr.		650
Southern Airways Co., Munic. Arpt., Birmingham, Ala.		Cont. 40	250 hr.	7/40	650
Allied Arcft., Davenport, Ia.	..	Cont. 40	385 hr.	100 hr.	650
Bayside Flyg. Serv., Hingham, Mass.	J-3	Cont. 40	800 hr.	110 hr.	650
Calkins Arcft., 1022 N.Atlantic, Seattle, Wash.		Cont. 40	1467 hr.	138 hr.	650
Jones Flyg. Serv., Columbus, Ohio.	J-3	Cont. 40	700 hr.	400 hr.	650
Seidner Fly. Ser., S.A.M. Arpt., Youngs., Ohio	J3	Cont. 40	600 hr.	80 hr.	625
Frost Air Serv., West Haven, Conn.		Cont. 40	355 hr.	recently	625
Calkins Arcft., 1022 N.Atlantic, Seattle, Wash.	J-2	Cont. 40	854 hr.	263 hr.	625
Wm. T. Anderson, P.O. Box 275, Essex Fells, N. J.	J3C	Cont. 40	600 hr.	yes	600
R. E. Lee, Munic. Arpt., Rocky Mount, N. C.	J2	Cont. A40-4	520 hr.	8/40	600
Clinton Arpt., Elliott Fly. Serv., DeWitt, Ia.	J2	Cont. 40	900 hr.	100 hr.	600
W.Va. Air Serv., Box 401, Clarksburg, W.Va.	J3C	Cont. 40	500 hr.	10 hr.	600
W. B. Jones, Arpt., Marlboro, Mass.	J2	Cont. 40		50 hr.	600
G. E. Moon, Airport, Mishawaka, Ina.	J-2	Cont. 40	150 hr.	none	600
Fox Valley Flyg. Serv., Aurora, Ill.		Cont.	850 hr.	150 hr.	600
Carolina Aircraft Sales, Munic. Arpt., Charlotte, N. C.	J2	Cont. 40	900 hr.	850 hr.	600
B. F. Dodson, 121 S. Iuka St., Pratt, Kan.	J3	Cont. A40A	660 hr.	617 hr.	600
Bayside Flyg. Serv., Hingham, Mass.	J-2	Cont. 40	850 hr.	50 hr.	595
West Coast Aircraft, Inglewood, Calif.	J-2	Cont. 40	250 hr.	250 hr.	595
Krantz Aero Serv., Pt. Erie Arpt., Pt. Erie, Pa.	J-2	Cont. 40	525 hr.	125 hr.	585
Livingston Airways, Arpt., Waterloo, Ia.	J2	Cont. 40	770 hr.	92 hr.	575
D. Rohn, 1300 Monroe, Beardstown, Ill.		Cont.	550 hr.	50 hr.	575
Southern Airways, Munic. Arpt., Birmingham, Ala.		40	700 hr.	9/1/40	550
Chas. Roberts, Mun. Arpt., Dothan, Ala.		Cont. 40	400 hr.	Mar. '40	550
L. Marshall, 1671 Haddon Av., Camden, N. J.	J2	Cont. 40	1000 hr.	Aug. '40	550
Bishop Fly. Ser. Arpt., Flint, Mich.		Cont. A40	600 hr.	35 hr.	550
Allstate Airways, Newton Rd., Haverhill, Mass.		Cont. A40	675 hr.	125 hr.	525
Daitz Fly. Corp., Roosevelt Field, Mineola, N. Y.	J2	Cont. 40	600 hr.	24 hr.	525
W. Blood Aircraft Sales, Charleston, W. Va.	J-2	Cont. 40	560 hr.	80 hr.	525
C. Breedlove, 2406-27th St., Lubbock, Tex.	J2	Cont. 40	700 hr.	35 hr.	500
Aviation Service, Hartford, Conn.	E-2	Cont. 40	998 hr.	283 hr.	500
Aviation Service, Hartford, Conn.	E-2	Cont. 40	323 hr.	285 hr.	500
R. Boekenhoff, Jr., 626 Maine, Quincy, Ill.	J2	Cont. 37	850 hr.	Aug. '40	500
Blvd. Airport, Inc., Roosevelt Blvd., Phil., Pa.	Mailwing PA-7-S	Wright 240	354 hr.	no	1800
PORTERFIELD					
Lenhart Fly. Ser., Munic. Arpt., Marion, Ind.	Deluxe	Warner 90	240 hr.	just	1495
Speed's Flyg. Serv., Holmes Arpt., Jackson Hts., N. Y.		Cont. 50	105 hr.		1200
Bethany Air Serv., Inc., Amity Rd., Bethany, Conn.		LeBlond	178 hr.		900
Geo. C. Haven, Schenectady, N. Y.		LeBlond 70	450 hr.	100 hr.	895
Livingston Airways, Arpt., Waterloo, Ia.		LeBlond 70	349 hr.	127 hr.	875
W. F. Luke, Schenectady, N. Y.		LeBlond 70	450 hr.	100 hr.	800
Hawthorne Fly. Serv., Munic. Arpt., Charleston, S. C.		LeBlond 70	350 hr.		795
S. P. Hale, Jr., 309 F St., Ardmore, Ohio.	Flyabout	LeBlond 70	750 hr.		775
Airways, Inc., Waterville, Me.		Cont. 40	68 hr.	new shp.	595
REARWIN					
Al Young, Somerset Pike, Johnstown, Pa.	Ranger	Cont. 75	none		2295
C. Evers, 247 Park Ave., N.Y.C.		Warner 90	138 hr.	none	2250
Falcon Aircraft, L. A. Mun. Arpt., Inglewood, Cal.	Speedster	Menasco125	150 hr.		2250
Falcon Aircraft, L. A. Mun. Arpt., Inglewood, Cal.	Sportster	LeBlond 90	450 hr.	recently	1700
California Aircraft, Van Nuys, Cal.	Sportster	LeBlond 90	469 hr.		1675
E. W. Wiggins, Airways, Providence, R. I.		LeBlond 90	400 hr.	130 hr.	1400
A. E. Padage, Tri-City Arpt., Wisc. Rapids, Wis.	90	LeBlond	178 hr.	73 hr.	1350
Four Lakes Aviation, Madison, Wis.	7000	LeBlond 70	300 hr.		1150
Jennings Bros., No. Grafton, Mass.		LeBlond 70	680 hr.	50 hr.	1075
Airways Inc., Waterville, Me.		LeBlond 85	280 hr.	new ship	1000
Racine Fly. Serv., Arpt., Racine, Wis.	7000	LeBlond 70	540 hr.	10 hr.	950
Aircraft Assoc., Inc., Munic. Arpt., Long Beach, Cal.	7000	LeBlond 70	1580 hr.	1150 hr.	900
N. R. McCray, Airport, Jamestown, N. Y.		Le Blond70	890 hr.	760 hr.	895
Aircraft Assoc., Inc., Munic. Arpt., Long Beach, Cal.	7000	LeBlond 70	1400 hr.	1350 hr.	850
ROBIN					
Fox Valley Flyg. Serv., Aurora, Ill.		Chall.	870 hr.	35 hr.	575
RYAN					
St. Louis Fly. Ser., Lambert Field, Robert, Mo.	STA	Menasco	708 hr.	recently	3250
Galvin Fly. Ser., Boeing Fld., Seattle, Wash.	B-5	Wright 330	3700 hr.	100 hr.	1350
Mid-Western Aviation Co., St. Joseph, Mo.	B-1	J-5-220	630 hr.	8 hr.	995
J. L. Schroeder, Houston, Texas.	B-1	Wright 220	634 hr.	21 yr.	875
J. O. Dockery, Stuttgart, Ark.		J-5	600 hr.	100 hr.	850
Oneal Aircraft, Vincennes, Ind.		J-5	950 hr.	200 hr.	850

FLYING and POPULAR AVIATION USED PLANE LISTING OF

DEALERS	MODEL AND ENGINE		TIME	OVER-HAULED	PRICE
SECURITY					
Aviation Service Co., Hartford, Conn.	S1A	Kinner 100	940 hr.	146 hr.	850
Aviation Service Co., Hartford, Conn.	S1A	Kinner 100	936 hr.	165 hr.	850
SIKORSKY					
E. W. Wiggins Airways, Providence, R. I.		S-39	400 hr.	recently	7500
Palm Beach Aero, Morrison Fd., W. Palm Beach, Fla.	S38B	Wasp 450	125 hr.	yes	5995
Gilpin Airlines Arpt., Tucson, Ariz.	S-39CS	Wasp, Jr.375	550 hr.	275 hr.	5600
C. Evers, 247 Park Ave., N.Y.C.	Amphib.	Wasp, Jr. 300			3800
SPARTAN					
Aero Brok. Ser., Inc., Metrop. Arpt., Van Nuys, Cal.	C3-3POLB	Wright R540 175	Air 580 Eng. 680	Eng. 241	950
Wichita Falls, Air Trans., Wichita Falls, Tex.		Wright 240	330 hr.	110 hr.	900
H. C. Nelson, 3322 Abner Pl., St. Louis, Mo.		Wright	420 hr.	April '35	845
SPORTWING					
Oakland Aircraft, Alameda, Calif.		Kinner 125	640 hr.	Jan. '40	2400
STEARMAN					
Aero Brok. Ser., Inc., Metro. Airp., Van Nuys, Cal.	4D 2 POLB	Wasp. Jr. SB 450	Air. 1500 Eng. 4300	650 hr.	2150
Upton & Bowen, West Memphis, Ark.		J69-330	500 hr.	50 hr.	1800
Aircraft Assoc., Inc., Munic. Arpt., Long Beach, Cal.	C3B	Wright J5			850
STINSON					
Hyannis Arpt., Box 592, Hyannis, Mass.	SR9BD	Lyc. 245	350 hr.	no	6000
W.Va. Air Serv., Box 401, Clarksburg, W.Va.	SR9CD	Lyc. 260	225 hr.	60 hr.	5995
Chi. Avi. Corp., Curtiss Arpt., Glenview, Ill.	Reliant SR8E	Wright 350	275 hr.	80 hr.	5750
Wright Fly. Serv., Scott Airport, Martins Ferry, Ohio.	SR9	Lyc. 245	540 hr.	55 hr.	5600
Piedmont Avi., Inc., Muni. Arpt., W-S. N. C.	Reliant	Lyco. 245	842 hr.	185 hr.	4885
Franklin Rose Aircraft, Alameda, Cal.	10	Cont. 80	225 hr.		3650
Leech Aircraft, Roosevelt Fld., Min., N. Y.	SR-9D	Wright 285			3500
Franklin Rose Aircraft, Alameda, Cal.	10	Cont. 80	50 hr.		3450
Portland Flyg. Serv., Portland, Me.	105	80 hp	110 hr.	none	3250
Aircraft Assoc., Inc., Munic. Arpt., Long Beach, Cal.	SR7B	Lyc. 245	839 hr.		3250
J. A. Atherton, Arpt., Rochester, Minn.		Cont. 80	70 hr.		3000
Leech Aircraft, Roosevelt Fld., Min., N. Y.	105	Cont. 80	160 hr.		2960
Pacific Dis. Corp., 1321 Flower St., Glen., Cal.	105	Cont. 75	10 hr.	no	2750
Chi. Avi. Corp., Curtiss Artp., Glenv., Ill.	SR5B	Lyco. 245	1000 hr.	100 hr.	2665
S. P. Hale, Jr., 309 F St., Ardmore, Ohio.	105	Cont. 75	160 hr.	just	2650
R. Turner Aero Corp., Indianapolis, Ind.		Cont. 75	165 hr.	none	2600
Geo. C. Haven, Schenectady, N. Y.		Cont. 75	90 hr.	none	2550
Sioux Skyw., Inc., Muni. Arpt., Si. Falls, S. D.	105	Cont. 80	210 hr.		2500
Johannesson Fly. Ser., Stevenson Arpt., Win., Can.	SM2A	J6-5-175	1750 hr.	May 39	2500
Leech Aircraft, Roosevelt Fld., Min., N. Y.	105	Cont. 75	545 hr.	385 hr.	2450
Genl. Aero. Corp., 1717 Ford Bldg., Detroit, Michigan.	105	Cont. 75	96 hr.		2450
Air Serv., Inc., Mun. Arpt., Denver, Colo.	105	Cont. 75	120 hr.		2400
Air Ser., Inc., Munic. Arpt., Denver, Colo.	105	Cont. 75	200 hr.	no	2400
Sharon Air Ser., 347 Vernon Ct., Sharon, Pa.		Cont. 75	250 hr.	none	2400
J. K. Hinson, Rutherford Fld., Woodlawn, Md.	SR6	Lyc. 225	1037 hr.	225 hr.	2390
Jenkins Air Serv., Inc., Rochester, N. Y.		Cont. 75	170 hr.		2350
Leech Aircraft, Roosevelt Fld., Min., N. Y.	105	Cont. 75	385 hr.		2350
Upton & Bowen, W. Memphis, Ark.	105	Cont. 75	250 hr.	50 hr.	2350
Bishop Fly. Ser., Arpt., Flint, Mich.	105	Cont. 75	140 hr.	no	2300
Chi. Avi. Corp., Curtiss Arpt., Glenvi., N. Y.	105	Cont. A75	400 hr.	20 hr.	2275
A. R. Currey, 452 Jefferson, Galesburg, Ill.	105	Cont. 75	500 hr.		2250
Safair, Roosevelt Fld., Mineola, N. Y.	SR6	Lyc. 245	95 hr.		2250
P. J. Sones, Co., Haines City, Fla.	105	Cont. 75	230 hr.	none	2250
Franklin Rose Aircraft, Alameda, Cal.	SR5	Lyc. 260	2500 hr.	July '40	2250
P. J. Sones, Co., Haines City, Fla.	SR-6B	Lyco. 245	590 hr.	190 hr.	2200
N. Okla. Fly. Ser., W. D. Mauk, Box 556, Bl., Okla.	SR5E	Lyco. 225	950 hr.	345 hr.	2000
Raymond Aero Serv. Co., Airport, Macon, Ga.		Wasp Jr.	950 hr.	Mar. '38	2000
Genl. Aero. Corp., 1717 Ford Bldg., Detroit, Michigan.	105	Cont. 75	635 hr.	162 hr.	1975
Genl. Aero. Corp., 1717 Ford Bldg., Detroit, Michigan.	105	Cont. 75	708 hr.	289 hr.	1975
K. S. Barber, Munic. Arpt., Pontiac, Mich.	105	Cont. 75	630 hr.	160 hr.	1950
Hawthorne Fly. Serv., Munic. Arpt., Charleston, S. C.	SR5A	Lyc. 245	850 hr.	just	1900
Morey Airplane Co., Madison, Wisc.		Lyc.	800 hr.	350 hr.	1900
Nashville Fly. Ser., Munic. Arpt., Nashville, Tenn.	SR33	Lyc. 215	1700 hr.	yes	1900
Hume & Smyer, Bx. 551, Arkansas City, Kans.	SR6	Lyc. 245	527 hr.	330 hr.	1875
J. Frank Wilson, New Kingstown, Pa.	SR-SR	Lyc. 225	650 hr.	450 hr.	1800
Miller Flyg. Serv., North Benton, Ohio.		Lyc. 225	565 hr.	May '39	1800
Matthews & Rap., Roosev. Fld., Mine, N. Y.	Sr.-Jr.	Lyco. 215	550 hr.	Aug. '40	1800
Pacific Dis. Corp., 1321 Flower St., Glen., Cal.	5M6000B	3 Lyco. 215	5918 hr.	735 hr.	1750
Page Airways, Inc., Rochester, N. Y.		Lyc.	1500 hr.	250 hr.	1750
Wright Fly. Serv., Scott Arpt., Martins Ferry, O.	1933	Lyc. 215	1100 hr.	245 hr.	1525
Brayton Flyg. Serv., Robertson, Mo.		Lyc.	738 hr.	126 hr.	1450
Moberly Fly. Ser., 605 Concannon St., Mob., Mo.		Lyco. R680	1240 hr.	40 hr.	1375
Akron Airways, Arpt., Akron, Ohio.	SR	Lyc.	850 hr.	350 hr.	1350
Akron Airw., Arpt., Akron, Ohio.		Lyco. 215	1200 hr.	315 hr.	1300
Chi. Avi. Corp., Palwaukee Arpt., Mt. P., Ill.	SR	Lyco. 215	1000 hr.	500 hr.	1295
J. L. Schroeder, Rt. 3, Box 117, Houston, Tex.	Reliant	Lyc. 215	460 hr.	no	1250
Canton Aviation Co., Canton, Ohio.		Lyc. 215		yes	1200
Huron Fly. Ser., Box 415, Huron, S. D.	SM8A	Lyco. 215	1900 hr.	8-20-40	1100
Seaboard Air Trans., Lumberton, N. C.	R	Lyco. 215	750 hr.	350 hr.	1100
Springfield Aviation, Arpt., Springfield, Ill.	SM-8A	Lyc. 215	760 hr.	360 hr.	1175
R. F. Turner, Airport, Spartanburg, S. C.	S	Lyc. 680	800 hr.	150 hr.	1150
Livingston Airways, Arpt., Waterloo, Ia.	SM8A	Lyc. 215	934 hr.	180 hr.	1050
Perkiomen Valley Arpt., Collegeville, Pa.	SM8A	Lyc. 215	1175 hr.		1000
Odessa Flyg. Serv., Odessa, Texas.	SM-2AB	Wright 220	1767 hr.	none	1000
Four Lakes Aviation, Madison, Wis.	SM-2AA	Wright 65	485 hr.	85 hr.	1000
C. A. Lewis, 776 S. Maffit St., Decatur, Ill.	SM1F	Wright 330	805 hr.	220 hr.	1000
Maheux's Arpt., Stevens Mill Rd., Auburn, Me.	SM8A	Lyc. 215			995
Livingston Airways, Arpt., Waterloo, Ia.	R	Lyc. 215	3144 hr.	251 hr.	975
E. Braden, Easton Arpt., Easton, Pa.	SM7A	Wright 330	750 hr.		950
Barr Aviation Corp., Detroit, Michigan.		Lyc. 215	890 hr.	5 hr. eng.	950
Decatur Aviation, 776 S. Maffit St., Decatur, Ill.	SM1F	Wright 330	825 hr.	250 hr.	895
Paul Eyster, Tri State Arpt., Ang., Ind.	SM8A	Lyco. 215	1600 hr.	250 hr.	850
Island Crop Dusting Co., Caribou, Maine.	SM1-D	Wright 225	500 hr.	30 hr.	800
Midwest Av. Sales, Stinson Arpt., LaGrange, Ill.	SM8A		2025 hr.	yes	800
Glens Falls Fly. Ser., Arpt., Glens Falls, N. Y.	SM8A	Lyc. 215	775 hr.	175 hr.	800
Leeward Aircraft, New Kensington, Pa.		Lyc. 215	900 hr.	250 hr.	795
Northway Flyg. Serv., Norton Fld., Columbus, O.	SM2AB	Wright 220	1200 hr.	Dec. '39	775
Piedmont Avi., Inc., Muni. Arpt., W-S., N. C.	SM8A	Lyco. 215	843 hr.	238 hr.	585
Ellis E. Eno, Eno Arpt., Ft. Dodge, Iowa.	SM1-K	Kinner 100	650 hr.	recently	515
P. A. Meinke, Route #3, Willa., Ohio.	SM-2	War-Sca-125		100 hr.	500
TAYLORCRAFT					
C. H. Kenyon, Grand Mere, Quebec.		Lyc. 55	93 hr.	none	1900
Little Corp. Patco Fly. Fld., Norristown, Pa.	Deluxe	Cont. 65	35 hr.		1900
Narragan. Avi. Ser., R. I. State Arpt., Hills., R.I.	DeLux	Cont. 65	202 hr.		1895
Springfield Aviation, Arpt., Springfield, Ill.	BC	Cont. 65	140 hr.	none	1895
Frantz Fly. Ser., Box 2504, Roanoke, Va.	40	Cont. 65	350 hr.		1800
Narragan. Avi. Ser., R. I. State Arpt., Hills., R.I.	DeLux	Cont. 65	308 hr.		1795
C. Breedlove, 2406-27th St., Lubbock, Texas	BL	Lyc. 65	175 hr	none	1750
C. R. Galloway, 3006 Hardie, Ft. Smith, Ark.	DeLux	Cont. 65	210 hr.	none	1750
C. Breedlove, 2406-27th St., Lubbock, Texas	BC	Cont. Dual 65	235 hr.	none	1750
Bishop Fly. Ser., Arpt., Flint, Mich.		Lyc. 65	50 hr.	new	1750
United Flyers, Inc., Ridgewood, N. J.	BL deluxe	Lyc. 65	165 hr.		1750
Leavens Bros., Barker Arpt., Toronto, Can.		Cont. 50	614 hr.		1750
Colo. Avia. Co., 1615 Albun St., Denver, Colo.		Cont. 65	less than 300 hr.		1725
C. Breedlove, 2406-27th St., Lubbock, Texas	BL	Lyc. 65	300 hr.	10 hr.	1700
Niederhauser Airways, Marshalltown, Ia.	BL	Lyc. 65	209 hr.	no	1650
Washington Pk. Arpt., Homewood, Ill.		Cont. 65	150 hr.	none	1650
Inter-City Fly. Ser., Muni. Arpt., Ft. Wayne, Ind.	Tay-65 DeLux	Cont. A-65-3	400 hr.	none	1625
Clinch Fly. Ser., Muni. Arpt., N. Pl., Neb.	B	Lyco. 65	1000 hr.	800 hr.	1600
L. E. Daniels, Crete, Ill.		Cont. 65	175 hr.	none	1595
Charles Feris, Hillside, Ill.		Lyco. 65	225 hr.		1500
Howard Travis, Big Rapids, Mich.	BL65	Lyc.	325 hr.		1500
Rochester Aero Corp., Rochester, N. Y.		Lyc.	250 hr.		1500
Fox Valley Flyg. Serv., Aurora, Ill.		Lyc. 65	125 hr.		1500
Ed. Nibur, Madiera Arpt., Bernharts, Pa.		Cont. 65	385 hr.		1500
Ben. A. Funk, Hy. #50, Grover, Mo.		Lyco. 65	30 hr.	since new	1495
Merrill Hale, Hillsgrove, R. I.		Cont. 65	490 hr.		1495
Inter-city Fly. Ser., Muni. Arpt., Ft. Wa., Ind.	Tay-50 DLX	Lyco. 50	150 hr.	none	1495
W. B. Jones, Arpt., Marlboro, Mass.		Lyc. 65	262 hr.		1475
Fox Valley Flyg. Serv., Aurora, Ill.		Lyc. 65	106 hr.		1475
C. R. Galloway, 3006 Hordie, Ft. Smith, Ark.	Delux	Lyco. 65	625 hr.	recent major	1475
Peoria Aero Sales, 342 Knoxville, Peoria, Ill.		Lyc. 65	40 hr.	none	1450
W. B. Jones, Arpt., Marlboro, Mass.		Lyc. 55	210 hr.		1450
Ed. Nibur, Madiera Arpt., Bernharts, Pa.		Lyc. 55	120 hr.		1450
Four Lakes Aviation, Madison, Wisc.	BL	Lyc. 65	399 hr.	30 hr.	1450
Aviation Country Club, Cedar Rapids, Ia.	BF	Frank. 50	110 hr.		1450
C. E. Dufort, Malone Arpt., Malone, N. Y.	BL	Lyc. 55	50 hr.	new	1400
Dawson Air Ser., Box 852, Salina, Kans.	Delux	Lyco. 55	600 hr.	40 hr.	1400
Washington Pk. Arpt., Inc., Homewood, Ill.		Lyc. 50	85 hr.	none	1390
Washington Pk. Arpt., Inc., Homewood, Ill.		Lyc. 50	104 hr.	none	1375
Fred Helm, Zap, No. Dakota.	BF	Frank. 50	170 hr.	none	1375
R. Koleman, 921 Hayes Ave., Fremont, Ohio.		Cont. 65	504 hr.	none	1375
Neiderhauser Airways, Marshalltown, Ia.	BL	Lyc. 65	450 hr.	no	1350
Hood Aircraft Sales Co., Northampton, Mass.		Cont. 50	200 hr.		1350
Athens Flyg. Serv., Athens, Ga.	BC 38	Cont. 50	418 hr.	385 hr.	1350
L. E. Daniels, Crete, Ill.	BT	Lyc. 50	125 hr.	none	1325
Reifenberg Aviation, St. Johns, Pa.		Lyc. 55	138 hr.		1325
Aviation Country Club, Cedar Rapids, Ia.	BC	Cont. 50	318 hr.	18 hr.	1300
Washington Pk. Arpt., Inc., Homewood, Ill.		Lyc. 55	235 hr.	none	1295
Valley Fly. Serv., Rt. 4, Box 132, Visalia, Calif.	BLT	Lyc. 55	400 hr.		1275
Peoria Sales, 342 Knoxville, Peoria, Ill.		Lyc. 50	210 hr.	none	1250
Ryan Air Serv., Decorah, Ia.		Lyc. 50	295 hr.		1250
Raymond Aero Serv., Macon, Ga.		Lyc.	685 hr.	Mar. '40	1250
Hubert & Dillon Air Serv., Tacoma, Wash.	B	Lyc. 55	1150 hr.	just	1250
Dawson Air Ser., Box 852, Salina, Kans.	Delux	Lyco. 55	600 hr.	50 hr.	1200
Clinch Fly. Ser., Mun. Arpt., N. Pl., Nebr.	B	Lyco. 50	700 hr.	yes	1200
Balt. School of Aero, Baltimore, Md.		Lyc.	341 hr.		1200
Four Lakes Aviation, Madison, Wisc.	BL	Lyc. 50	490 hr.	none	1200
Gilpin Airlines, Arpt., Tucson, Ariz.	BC	Cont. 50	500 hr.		1200
R. Turner Aero Corp., Indianapolis, Ind.		Frank. 50	247 hr.	top	1200
Greenville Sch. of Avia., Greenville, Ohio.		Lyc. 145	232 hr.	June '40	1200
Dubuque Airways, Dubuque, Ia.	BL	Lyc. 50		none	1200

AUTHORIZED AIRCRAFT DEALERS

DEALERS	MODEL AND ENGINE		TIME	OVER-HAULED	PRICE
Hubert & Dillon Air Serv., Tacoma, Wash.	B	Cont. 50	1200 hr.	yes	1200
L. E. Daniels, Crete, Ill.		Lyc. 55	300 hr.	none	1195
J. Frank Wilson, New Kingstown, Pa.	BL	Lyc. 55	250 hr.		1185
Hubert & Dillon Air Serv., Tacoma, Wash.	A	Cont. 40	650 hr.	yes	1150
H. C. Phillips, Arpt., Mt. Pleas., Mich.		Lyco. 50	700 hr.	650 hr.	1150
United Flyers, Ridgewood, N. J.	BF	Frank. 50	220 hr.		1150
Hopewell Flyg. Serv., Hopewell, Va.		Frank. 50	275 hr.	none	1150
A. J. Moore, 324 State St., Baden, Pa.		Lyc. 55	435 hr.	40 hr.	1150
Schneider Aero Serv., Fresno, Cal.		Cont. 50	737 hr.	49 hr.	1150
H. C. Phillips, Arpt., Mt. Pleas., Mich.		Lyco. 50	950 hr.	950 hr.	1150
Canton Aviation, Canton, Ohio		Lyc. 50	291 hr.	yes	1150
Raymond Aero Serv., Macon, Ga.		Cont.	550 hr.	Nov. '39	1150
Canton Aviation, Canton, Ohio	BL deluxe	Lyc. 50	300 hr.		1100
Rochester Aero Corp., Rochester, N. Y.		Lyc.	475 hr.	25 hr.	1100
Colo. Avi. Co., 1615 Albun St., Denver, Colo.		Cont. 50	600 hr.	recent	1100
Oscar L. Hostetter, York Arpt., Thomsv., Pa.	BL	Lyco. 50	475 hr.		1100
Narragan. Avi. Ser., R. I. State Arpt., Hill., R.I.		Cont. 50	600 hr.	540 hr.	1075
Dubuque Airways, Dubuque, Ia.	BL	Lyc. 50	600 hr.	100 hr.	1050
L. A. Musgrove, Box 814, Morgant., W. Va.		Lyco. 50	475 hr.	175 hr.	1050
C. E. Dufort, Malone Arpt., Malone, N. Y.	BF	Frank. 50	550 hr.	60 hr.	1050
Merrill Hale, Hillsgrove, R. I.		Frank. 50	268 hr.	35 hr.	1050
L. A. Musgrove, Box 814, Morgant., W. Va.	T	Lyco. 55	650 hr.	200 hr.	1000
Moberly Fly. Ser., 605 Concannon St., Mob., Mo.		Frank. 50	650 hr.	100 hr.	995
Piedmont Avi., Inc., Muni. Arpt., W-S., N. C.		Frank. 50	538 hr.		975
C. Breedlove, 2406-27th St., Lubbock, Texas	BL Tr.	Lyc. 50	550 hr.	none	950
Dubuque Airways, Dubuque, Ia.	BF	Frank. 50	400 hr.		950
Inter-City Fly. Ser., Muni. Arpt., Ft. W., Ind.		Frank. 50	400 hr.	yes	950
Dewey Eldred Fly. Ser., Lost Nation Rd., Willoughby, Ohio		Lyc. 55			950
R. D. Lyon, RD No. 1, Warren, Ohio		Lyc. 50	500 hr.	yes	895
W. F. Luke, Airport, Schenectady, N. Y.		Frank. 50	350 hr.		825
Dennison Arpt. Oper. Co., Arpt., Quincy, Mass.	A	Cont. 40	1000 hr.		800
Jennings Bros., No. Grafton, Mass.		Cont. 40	660 hr.	100 hr.	800
Hubert & Dillon Air Serv., Tacoma, Wash.	A	Cont. 40	950 hr.	yes	800
I. Munroe, Inc., P.O. Bx. 957, Tallahassee, Fla.	A	Cont. 40	225 hr.	25 hr.	800
Aviation Country Club, Cedar Rapids, Ia.	A	Cont. 40	685 hr.	June '40	800
Stinson Flyg. Corp., Glendale, Calif.		Cont. 40	1100 hr.	170 hr.	760
Valley Fly. Serv., Rt. 4, Box 132, Visalia, Cal.	A	Cont. 40	650 hr.	no	750
Buroker-Hicks Flyg. Serv., Olympia, Wash.	A-2PCLM	Cont. 40	450 hr.	none	750
Athens Flyg. Serv., Athens, Ga.	38	Cont. 40	618 hr.	560 hr.	750
Ryan Air Service, Decorah, Ia.		Cont. 40	326 hr.		750
United Flyers, Inc., Ridgewood, N. J.	A	Cont. 40	250 hr.		750
Sky Harbor, Inc., Indianapolis, Ind.	A	Cont. 40	521 hr.	Aug. '39	750
H. S. Smith, 422 S. Union St., Warsaw, Ind.		Cont. 40	800 hr.	100 hr.	750
E. W. Wiggins Airways, Providence, R. I.		Cont. 40	650 hr.	none	735
A. R. Smith, 113 E. Commerce, Aberdeen, Md.		Cont. 40	850 hr.	Oct. '39	725
Sweet Fly. Ser., Visalia Mun. Arpt., Vis., Cal.	A	Cont. 50	839 hr.	100 hr.	725
Dewey Eldred Fly. Ser., Lost Nation, Willoughby, O.		Cont. 40			700
Carnahan Flyg. Ser., Bloomington, Ill.		Cont. 40	507 hr.	100 hr.	700
Clinch Fly. Ser., Muni. Arpt., N. Pl., Nebr.	A	Cont. A40	850 hr.	700 hr.	700
Merrill Hale, Hillsgrove, R. I.		Cont. 40	1081 hr.	100 hr.	695
Susquehanna Air Ser., Montoursville, Pa.		Cont. A40	940 hr.	340 hr.	685
J. F. Whickir, Mun. Arpt., Ft. Wayne, Ind.		Cont. 40	430 hr.		675
E. E. Lee, Munic. Arpt., Rocky Mount, N. C.		Cont. 40	465 hr.	9/40	650
J. L. Wells, 106 W. Main, Avon Park, Fla.		Cont. 40	690 hr.	100 hr.	650
Cape Aircraft, Inc., Falm. Arpt., Hatch., Mass.	A	Cont. 40	350 hr.	none	650
Howard Fly. Ser., Bx. 565, Ames, Iowa		Cont. A40	875 hr.	75 hr.	650
H. G. Phillips, Arpt., Mt. Pl., Mich.		Cont. 40	700 hr.	600 hr.	650
Bishop Fly. Ser., Arpt., Flint, Mich.		Cont. A40	800 hr.	50 hr.	650
United Flyers, Inc., Ridgewood, N. J.	A	Cont. 40	460 hr.	20 hr.	625
L. A. Musgrove, Box 814, Morgant., W. Va.	A	Cont. A40	700 hr.	100 hr.	600
Jersey Fly. Ser., No. Jers. Arpt., Oak., N. J.		Cont. 40	700 hr.	150 hr.	600
Palm Beach Aero Corp., W. Palm Beach, Fla.		Cont. 40	238 hr.		595
Chas. Ferris, Hillside, Ill.	A	Cont. A40	900 hr.	750 hr.	575
Joe Cox, Knox, Indiana	Chumney	Kinner 90		yes	550
Inter-City Fly. Ser., Mun. Airp., Ft. W., Ind.	Cub	Cont. 40	600 hr.	yes	550
Stiles Motor Co., 260 Main St., Northp., N. Y.	Cub	Cont. 40	640 hr.	Aug. '40	550
Hobl-May. Air Ser., N. O. Arpt., New Or., La.	A	Cont. 40	1000 hr.	150 hr.	500
TRAVELAIR					
A. Whittaker, Portland Arpt., Port., Ore.	16K	125 Kinner	1300 hr.	1300 hr.	2500
Bayside Fly. Ser., Hingham, Mass.	6000	Wright 330	1600 hr.	25 hr.	1795
California Aircraft, Van Nuys, Calif.	A-14-D	Wright 240	1082 hr.	20 hr.	1750
Lynchburg Tran., Preston Glenn, Lynch., Va.		J5-225 Wright	800 hr.	recov. now	1600
E. W. Wiggins Airways, Norwood, Mass.		S-6000-B	1000 hr.	recently	1600
Bayside Fly. Serv., Muller Arpt., Revere, Mass.	S 6000B	Wright 300	1600 hr.	3/15/39	1595
Jones Flyg. Serv., Columbus, Ohio		Wright J-5	500 hr.	May '38	1250
W. Arnet Speer, 3330 Barnett, San Diego, Calif.	B-4000	Wright J5-225	1348 hr.	104 hr.	1250
Sky Harbors, Inc., Indianapolis, Ind.		Wright	600 hr.	80 hr.	1200
J. Frank Wilson, New Kingstown, Pa.	E-4000	Wright 175	750 hr.	60 hr.	1185
Hass-Hill. Fly. Ser., Mun. Arpt., Evans., Ind.	E-4000	Wright 175	1000 hr.	100 hr.	1100
N. Idaho Fly. Serv., Weeks Fld., Coeur D'-Alene, Idaho	4000	Wright J5-220	1100 hr.	1050 hr.	1100
Ashcraft Bros. Fly. Serv., Arpt., Lawrence, Kan.	B-4000	Wright 220		15 hr.	1000
Ray Porter, Chagrin Arpt., Willoughby, O.	C-4000	Chall. 185	650 hr.	just	1000
Odessa Flyg. Serv., Odessa, Texas	4000	Wright 220	506 hr.	489 hr.	1000
Bayside Flyg. Serv., Hingham, Mass.	10-D	Wright 250	700 hr.	40 hr.	950
Aero Serv., McKinley Arpt., Canton, Ohio	Trainer	Wright Gipsy 96	700 hr.	5 hr.	800
V. S. King, Warren Arpt., Warren, Pa.	2000	Tank 73-115	Ship 725 hr. Motor 430 hr.	40 hr.	525

DEALERS	MODEL AND ENGINE		TIME	OVER-HAULED	PRICE
Northway Flyg. Serv., Columbus, Ohio		Wright 220	1100 hr.		950
Bayside Fly. Serv. Muller Arpt., Revere, Mass.	10-D	Wright 240	513 hr.	11/10/39	895
D. Schall, 33 Claggett Rd., Hyattsville, Md.	Sport	Wright 90	600 hr.	80 hr.	875
A. Whitaker, Portland Arpt., Port., Ore.		Wright J-5	800 hr.	780 hr.	875
Stinson Flyg., 1044 Airways, Glendale, Cal.	4000	Wright 220	750 hr.	100 hr.	850
North-West Jersey Air Serv., Clinton, N. J.	C-4000	Chall. 185	310 hr.	yes	850
Wright Fly. Serv., Scott Arpt., Martins Ferry, O.		Warner 125	475 hr.	105 hr.	775
Al Leeward, New Kensington, Pa.		Challenger 185	700 hr.	16 hr.	765
Hudson Valley Aircraft, Middletown, N. Y.		Kinner 100	800 hr.		750
Hudson Valley Aircraft, Middletown, N. Y.		Kinner 100	800 hr.	3 hr.	750
Dupont Airport, Wilmington, Del.	E-4000	Wright 175	830 hr.		745
St. Louis Fly. Ser., Lambert Fld., Roberts, Mo.		Wright 90	480 hr.	just ove.	745
Leeward Aircraft, New Kensington, Pa.		185 Challenger	700 hr.	16 hr.	695
A. R. Currey, 452 Jefferson, Galesburg, Ill.	9000	Siemans 128	700 hr.		595
WACO					
E. W. Higgins Airways, Providence, R.I.	N	285 HP	325 hr.	none since	6500
J. W. Stewart, 1319 Avery St., Parkersburg, W. Va.	N	Jacobs 330	105 hr.		6500
Lane Avi. Corp., Cleve. Arpt., Cleve., Ohio.	ZGC	Jacobs 285	800 hr.	150 hr.	5500
H. S. Smith, 422 S. Union St., Warsaw, Ind.	Custom	Jacobs 285	210 hr.		4850
Sundorph Aero, Airport, Cleveland, O.	Custom	Jacobs 285	350 hr.	now	4500
A. E. Padage, Wisconsin Rapids, Wisc.	Custom	Jacobs 285	360 hr.	40 hr.	4500
Falcon Aircraft, Inglewood, Cal.	F-7	Jacobs 285	140 hr.		4250
Hawthorne Flying Serv., Munic. Arpt., Charleston, S. C.	ZPF7	Jacobs 285	600 hr.	250 hr.	3500
E. W. Wiggins Airways, Providence, R. I.	S	Jacobs 225	740 hr.	40 hr.	3500
E. W. Wiggins Airways, Providence, R. I.	Custom	Wright 285	300 hr.	100 hr.	3000
Sterling Airways, Sterling, Col.	YKS Cabin	Jacobs 225	350 hr.	48 hr.	3000
California Aircraft, Van Nuys, Cal.		Jacobs 285	512 hr.	66 hr.	3000
Mississippi Airways, Jackson, Miss.		Jacobs 225	295 hr.		2800
Daitz Fly. Corp., Roosevelt Fld., Mineola, N.Y.	CUC	Wright 250	315 hr.	15 hr.	2850
R. Turner Aero Corp., Indianapolis, Ind.		Jacobs 225			2750
N. R. McCray, Arpt., Jamestown, N. Y.	CSTD	Jacobs 225	380 hr.	275 hr.	2650
Nashville Flying Serv., Munic. Arpt., Nashville, Tenn.	Custom 35	Jacobs 225	732 hr.	50 hr.	2500
Inter-City Arli., Bost. Muni. Arp., E. Bos., Mass.		Jacobs 225 L4	845 hr.	213 hr.	2500
Spartan School of Aero., Box 2551, Tulsa, Okla.	ZKS	Jacobs 285	1100 hr.	400 hr.	2500
Calkins Arcft., 1022 N. Atlantic, Spokane, Wash.	UIC-4-PCLB	Cont. 210	921 hr.	just	2450
Air Ser., Inc., Munic. Arpt., Denver, Colo.	Custom	Jacobs 225	1000 hr.	200 hr.	2400
Bowman Fly Ser., Arpt, Keene, N. H.	NKC-S	Cont 210	550 hr	145 hr.	2300
K. S. Barber, Munic. Arpt., Pontiac, Mich.	YKS6	Jacobs 225	540 hr.	250 hr.	2250
Wallace Aircraft Co., Clarcona, Fla.	S	Jacobs 225	450 hr.		2250
B. F. Hines, Mex.-Tex. Arpt., Hobbs, N. M.		Jacobs 210	400 hr.		2100
Sioux Skyw. Muni. Arpt., Si. Falls, S. D.	36 Custom	Jacobs 225 L4	625 hr.	50 hr.	2100
J. Ruzuika, Circus City Arpt., Peru, Ind.	Cabin	Jacobs 225	700 hr.	110 hr.	2000
Beebe Air Serv., Hastings, Neb.		Cont.	450 hr.	Dec. '39	2000
C. W. Peterson, Peterson Fly. Ser., Sal., Kan.	YOC	Jacobs 225	605 hr.	532 hr.	2000
Tenn. Aero Corp., Nashville, Tenn.		Cont. 210			2000
J. L. Wells, 106 W. Main, Avon Park, Fla.	YKC	Jacobs 225	650 hr.	200 hr.	2000
R. K. Benson, 232 Keller Ave., Kenmore, N. Y.	YKC	Jacobs 225	800 hr	6/15/40	1950
Speed's Flyg. Serv. Jackson Hts., N. Y.	RNF	Warner 125	850 hr.	80 hr.	1800
H. G. Phillips, Arpt., Mt. Pl., Mich.		Cont. 210	500 hr.	approx. 200 hr.	1700
L. H. Melter, Solon Arpt., Solon, Ohio	YKC	Jacobs 225	650 hr.	450 hr.	1700
W. F. Luke, Airport, Schenectady, N. Y.		Cont. 210	525 hr.	100 hr.	1650
Lyn. Air Tran & Sales, Preston Glenn, Lyn, Va.	RNF	Warner 125	800 hr.	30 hr.	1650
Airways, Inc., Waterville, Me.		Cont. 210	640 hr.	138 hr.	1600
R. K. Bensen, 232 Keller Ave., Kenmore, N. Y	Cabin & SC	Cont. 210	875 hr.	10/10/40	1575
Red Bank Arpt., Inc., R. B., N. J.	YKC	Jacobs 225	895 hr.	85 hr.	1500
B. Frame, Lovell Arpt., Chattanooga, Tenn.		Cont. 165	826 hr.		1495
Falcon Aircraft, Inglewood, Cal.	Cabin	Cont. 210	800 hr.	150 hr.	1495
Lexington Flyg. Serv., Lexington, Ky.		Jacobs	680 hr.	127 hr.	1475
Reifenberg Aviation, St. Johns, Pa.		Cont. 165	485 hr.		1395
R. E. Lee, Munic. Arpt., Rocky Mount, N. C.	UEC	Cont. 210	870 hr.	9/40	1380
Walz Corp., Central Arpt., Camden, N. J.	Cabin	Cont 210	1658 hr.	1658 hr.	1275
Arents Air Serv., Armonk, N. Y.	OEC	Kinner 210	775 hr.	40 hr.	1275
Bishop Fly. Ser., Arpt., Flint, Mich.	F	Kinner 125	520 hr.	35 hr.	1250
Rocky Mt. Fly. Ser., Muni. Ser., Roc. Mt., N. C.	UEC	Cont. 670-210	860 hr.	1937 hr.	1250
W. P. Snyder, 417 W. Mulberry, Kokomo, Ind.	Taperwing	Wright J5-9-220	650 hr.	200 hr.	1225
Louisville Flyg. Serv., Inc., Louisville, Ky.		Cont. 210	768 hr		1195
SE Kansas Aircraft, Chanute, Kans.		Warner		150 hr.	1150
O. E. Dickerhoof, Chanute, Kans.		Warner 125	450 hr.		1150
W. P. Snyder, Mulberry St., Kokomo, Ind.	Taperwing	Wright		yes	1100
G. C. Haven, Schenectady, N. Y.		Warner 125	1000 hr.	200 hr.	1100
St. Louis Fly. Ser., Lambert Fld., Rob., Mo.	F	War-Scarab	1158 hr.	recently	1100
St. Louis Fly. Ser., Lambert Fld., Rob., Mo.	F	Kinner B-5		recently	1100
Racine Fly. Serv., Arpt., Racine, Wisc.	Taperwing	Wright 250	360 hr.	10 hr.	1050
Southern Air Serv., Memphis, Tenn.		Warner125	1000 hr.	recently	1050
Chapman Air Serv., New Orleans, La.		Warner		50 hr.	1050
N. R. McCray, Airport, Jamestown, N. Y.	F	Warner 125	680 hr.	575 hr.	995
Seidner Fly. Ser., S. A. M. Arpt., Youngs., Ohio	St.-Wing	Wright 220	800 hr.	80 hr.	995
Ranger Flyg. Serv., Ranger, Texas	RNF	Warner 125	1050 hr.	(1939)	975
J. K. Hinson, Rutherford Field Woodlawn, Md.	F	Kinner B5	571 hr.	150 hr.	950
N. Air Ser., Gr. Ra. Arpt., Grand Rapids, Mich.	KNF	Kinner 100	962 hr.	yes	950
Aero Ways, Inc., Cleveland, Ohio		Warner	801 hr.		950
Aero Ser., Inc., McKinley Arpt., Canton, Ohio	Str.-Wing	Wright J-5	800 hr.	50 hr.	950
Greenville School of Aviation, Greenville, O.	F	Kinner 125	1100 hr.	June '40	950
Cincinnati Aircraft Serv., Cincinnati, O.		Warner 125	950 hr.		925
N. R. McCray, Airport, Jamestown, N. Y.	A	Jacobs 170	575 hr.	525 hr.	895

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